THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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AT HOME AND ABROAD.

WE have now passed through a Parliamentary election which may largely decide the course of public affairs for several years to come.

After so many restless and unsettled years it is not surprising that the great majority of the electors prefer peace and tranquillity at any rate for the present rather than sensational and costly alleged panaceas. Peace and tranquillity are not incompatible with the removal of evils and grievances of certain sorts, indeed they can only be secured as we courageously face some of the most outstanding evils of our day. To our mind the most immediately serious one of all is that of unemployment, and we believe our conviction to be shared at any rate by the largest two parties in the newly-elected House of Commons because they represent the employing and employed interests in the nation. Peace in industry is what has been sorely needed, much talked about, and frequently negotiated for. Does not the present constitution of parties bring the ideal much nearer realisation if they will only see the wisdom of putting their heads and hearts together in regard to so vital a matter?

The mere facts that the Election is a thing of the past, and that the best and the worst are known, may alone do something to restore confidence and equanimity where previously there was a certain degree of nervousness which naturally restricted enterprise and expenditure, and therefore hampered industry and trade. There may be certain special ways by means of which enlightened official action may lead to less unemployment, but whatever may have been contemplated by the late Cabinet and whatever may be on the tables of permanent officials in the shape of new proposals for adoption by the new Government, we feel it to be most essential that new encouragement and backing should be given to those who, acting under Government authority and control, are responsible for the development of our overseas trade. Happily this constructive, trade-promoting, employment-producing department was saved, under pressure from those who knew what its potentialities were, when some of the Geddes cuts were being put into effect. But something more than the mere saving of the department from execution is required. What is important now is that our legislators and the public, too, should have a practical understanding of the valuable service that such a Department is capable of rendering. Under war conditions we listened to Cabinet Ministers and others as they held forth in regard to the great schemes that were to be carried into effect whereby we were to secure far better and far more extensive Governmental trade representation in all parts of the world. But the changes that have taken place in the Cabinet representation of the Department of Overseas Trade during the last few years have been so frequent that it has seemed to be treated more as a Cabinet Minister's plaything than a serious part of the Government service. May we hope for more stability there now, so that those at the Head may devote them-

selves zealously to the ways in which continuity of policy, and that policy *progressive*, may be assured? We have always regarded Governmental activities of this class in aid of Colonial and foreign trade encouragement as being an investment which would pay for itself again and again, and it is interesting, to say the least of it, that Sir Eric Geddes, with whose name was associated the proposal that Governmental activities should lessen, is nominated as the next president of the Federation of British Industries whose schemes for export trade organisation are of such importance and promise.

The importance of our Trade Commissioner service is no new theme with the Electrical Review. We were deeply disappointed when the proposals for extending this service were whittled down. How many good intentions of the last few years have come to naught! Yet we do not know that we are more concerned about the reduction of the early scheme than we are about the lack of recognition that exists regarding the value of the services of Trade Commissioners, when men of experience and ability are chosen, if they can be given such status and powers of action as will enable them to build up an influence as Ambassadors of British commerce. Our prolonged interest in Colonial and foreign electrical trade has brought clearly before us the usefulness of His Majesty's Trade Commissioners, and has caused us to take a larger view of their office. We have not the slightest hesitation in saying that far greater successes than we have noted might have been achieved if greater freedom and opportunity had been accorded.

There are many things that matter more than the answering of questions and the preparing of annual reports; these, of course, are essential, but they are by no means all.

Elsewhere in this issue we publish several Colonial and foreign electrical articles which but for pressure upon our space and lateness of the mails would have appeared in our "Jubilee" issue. Among these is one relating to New Zealand's electrical programme for the future. New Zealand has been a name to conjure with here for some time past because British factories have been receiving most helpful contracts therefrom providing employment for our workpeople. When, therefore, one of the most urgent questions before us as a people is the finding of useful and profitable work, it is only right that we should state that in regard to the electrical contracts referred to it is within the knowledge of the Electrical Review that the Department of H.M. Trade Commissioners was able to use valuable influence in securing that this very desirable business should find its way to British electrical manufactories for execution.

We hope that by means of the foregoing comments we shall impress those responsible for the appointments and status of our foreign trade representatives with the potentialities that this part of our national organisation possesses for producing work for British hands and food for British stomachs.

The Theory and Practice of Salesmanship.

Mr. Attwood's lecture at the E.D.A. Salesmanship Conference, on November 17th, certainly got to the heart of things to a degree which none of the previous lectures had equalled. That, perhaps, was because it was of a general and not of a particular nature. Largely, it was a repetition of obvious truths, and yet the strength of Mr. Attwood's position in urging the obvious was in the fact that the commercial side of the industry needs a good deal of boosting to make it at all on a par, as regards efficiency, with the technical side. The lecture dealt with first principles of salesmanship, and but for the lecturer's oratorical mannerisms might almost have been regarded as too elementary, at any rate at the beginning, yet it is only by close attention to first principles in commerce as in science that the object aimed at can be secured. Speaking broadly, the lecture ought to have been delivered to the staff people in the electrical industry who have the actual selling to do. We do not know how many such were present, but it is a fair assumption that the majority present were those who had to employ salesmen. The lecture, and the subsequent two, are not likely to fail of their object on that account, for it must have driven home to all who heard it the foolishness of imagining that to get sales only needs a good article, and that the person whose job it is to sell needs nothing more than a knowledge of the article he is selling. There appears to be a little controversy as to whether a salesman can be made or whether he must be born. Obviously there must be a right type of man to begin with, but if Mr. Attwood has done nothing more than drive home that even the man with a *flair* for selling must be trained, then he will have done good service to the industry. Apart from that, the outstanding point made in the first of these three lectures by one outside the industry, and who therefore came to the task with a new point of view, was that the public was not being adequately kept in touch with what electricity and electrical apparatus had to offer. That is the fundamental starting point, because without that aid the best of salesmen will find their task an uphill one. Few, if any, of the general public read the trade papers, and we confess to a feeling that general advertisements in the daily Press, even with ingeniously worded slogans, are almost useless. Something much more precise and specific is required. The thousands of households that use electricity for lighting only are in themselves a promising field for the operations of the electrical salesman, and means can easily be devised for getting into direct touch with them. That is only one small instance. There can be no two opinions that the public is far too ignorant on electrical matters, and one of the first objects of these conferences should be to change that, and quickly.

Standardisation of Cookers.

The action of the I.M.E.A. in calling conferences throughout the country to stimulate the use of domestic electrical apparatus will certainly lead to useful results. The meeting for the Greater London area took place at the Institution of Electrical Engineers recently. The results must, we think, be judged more by the usefulness of the discussion than by any definite conclusions arrived at. The purpose of these meetings is mainly to deal with the standardisation of cooking and other domestic apparatus. But, so far as the London meeting was concerned, the feeling seemed to be that rigid standardisation was hardly a practical proposition, anyhow at the moment. This, perhaps, will be generally agreed since there is still a considerable variety of opinion as to details of design of cookers, and we can easily understand that the supply industry and manufacturers generally are unwilling to commit themselves straightway to finality. At the same time, even if standardisation cannot be put into actual practice at the moment, it is certainly important that it should be kept as an ideal. Even if the details of cookers and other apparatus cannot be actually stereotyped, the main lines of design might be agreed. The great thing is to aim at standardisation and to take every opportunity of getting nearer and nearer to it.

Unless certain broad types generally approved throughout the industry can be evolved, electric cooking will never go forward by leaps and bounds. In the first place it is obvious that until manufacturers can go in for mass production, the cookers will never come down to bed-rock prices. Further, the difficulty over types of cookers and the constant changes taking place in design all militate against enthusiasm on the part of supply undertakings and electrical contractors in pushing cookers. There is a feeling of uncertainty that ought to be dispelled and which would be dispelled if something like standardisation came along. As everyone knows, a vast amount of money has been spent in experimenting with electric cooking, a good proportion of which has led up blind alleys. We are surely now getting near the time when good and bad propositions can

be sifted out, and the present move of the I.M.E.A. is certainly a much-needed one. It is to be hoped that, although the results at the moment may be inconclusive, the ideal will still be kept in mind and continuous efforts made to approximate to it.

Shortening Procedure.

The issue of a supplementary Memorandum by the Electricity Commission in regard to local inquiries indicates a most praiseworthy intention, namely, that of abbreviating as far as possible the procedure at the public inquiries devoted to examining reorganisation schemes under the Electricity Supply Act. We can always take it for granted, of course, that the Electricity Commissioners are desirous of economising their own time in these inquiries and also of saving expenses to other people. But this view is often not shared by the people who are taking part in the inquiry, in fact some of the inquiries have been scandalously long, and certain parties have occupied the time of the Court to a quite unwarranted extent. The Greater London inquiry, for instance, lasted 26 days and over 12,000 questions were asked, to say nothing of counsels' interpolations. And then to put the lid on the whole thing, certain criticisms were directed obliquely at the Commissioners for involving these litigious-minded parties in big expenses!

The present Memorandum as to procedure is mainly directed to Second Inquiries, a good many of which are now coming along. These Second Inquiries will be held under Section 5 (4) of the Electricity (Supply) Act, 1919, when any scheme which the Commissioners have formulated or approved after a First Inquiry will be finally submitted. It is to be hoped that all parties who propose to attend Second Inquiries will give very diligent heed to the Electricity Commissioners' polite intimations contained therein. In the first place, they say that "it is unnecessary that previous evidence should be repeated at the Second Inquiry"; that any parties may make general statements on any point of principle dealt with in the schemes, but unless they want to do so they need not support this by evidence. The procedure suggested by the Commissioners is to take each of the clauses in the scheme or the draft Order and hear representations.

Further, the talk about expenses has evidently been borne in mind by the Commissioners, and they say that while the matter is entirely at the discretion of the parties interested, unless important new issues are to be raised it would not ordinarily appear necessary for parties to be represented by counsel—a suggestion which should save time as well as money.

The I.E.E. Meetings.

Experience tells us that to comment on the proceedings at the "informal meetings," even with the most friendly intentions, may bring down upon us a stern reproof; nevertheless, we are impelled once more to run the risk, in view of recent observations.

These meetings were initiated largely for the purpose of inducing the younger members of the Institution to take part in discussion, the procedure being freed from the formality which necessarily reigns at the ordinary general meetings, and the speeches not being reported in the Press. The success of this policy was unquestioned and immediate; excellent discussions have been held, and the plan has been adopted not only at some of the provincial Centres of the Institution, but also by other engineering bodies. (By the way, we believe the Junior Institution of Engineers should have credit for the original idea.) But apparently the privacy of the meetings did not prove altogether satisfactory; the Press, of course, did not report the proceedings, but an official précis was issued, and this has now developed into a pretty full report—over 1,000 words. Moreover, there appears to be a tendency for "front-bench" members to take part in the discussions to an increasing degree. No doubt they have the right to do so—and the Committee has the right to issue a report to the Press; if the present procedure satisfies the junior members for whose benefit the informal meetings were started, well and good.

On the other hand, a change is taking place in the ordinary general meetings: in London the President has abandoned the practice of calling upon members by name to speak in the discussions, and now looks to them to take the initiative; and at Manchester the Chairman is appealing to the "smaller men" to take part in the discussions. These, it will be noticed, are steps in the direction of the "informal meetings" procedure. We do not suppose that they will go further; but it is interesting to observe this tendency at both classes of meeting to approximate to a common pattern.

Britain and the Italian Market.

In a report to his Government on the pump trade in Italy, the Canadian Trade Commissioner, Mr. W. McL. Clarke, makes a rather disconcerting statement regarding Britain's share in this business. His assertion seems to merit investigation both by our pump manufacturers and by our electric motor builders. After recalling that a not inconsiderable part of Italy's pre-war demand for hydraulic machinery was supplied by Great Britain, he adds that while we continue to hold a certain amount of this trade, he has been informed that it has always been difficult for the English manufacturer to obtain any large share in the pump business, as "most English pump makers do not manufacture electric motors, and it would not be a paying proposition to buy electric motors in order to sell the pumps, as the motor and fittings generally cost more than the pump itself." It seems here to be implied that there is not sufficient co-operation between the British pump-makers and electrical manufacturers to enable them to put forward a comprehensive tender at a competitive price. On the contrary, we believe that these two branches of the engineering industry act in close consultation, and we cannot think that their co-operation results in nothing more than the loading of the combined quotation with too heavy commission or otherwise spoiling the chances of obtaining export orders. Perhaps the firms principally concerned will put their Italian customers right on this point. Mr. Clarke has a further criticism to make on the subject of Britain's part in selling pumps overseas. He says that English centrifugal pumps are not usually suitable for coupling direct to electric motors, as they are not designed for the speeds at which motors run. Here is another point that needs correction. The whole matter is of particular interest at this juncture, because Germany, which has been dumping hydraulic plant in the Italian market, is unlikely to be able to continue such a policy very much longer, and there should consequently be an opportunity for Great Britain to regain her pre-war position.

The E.T.B.I.

On November 29th the Festival Dinner of the Electrical Trades Benevolent Institution will be held, Sir James Kemnal presiding. We hope that it will be well patronised, not only because it is always an interesting and enjoyable function, but also, and still more, because it is designed to promote the interests of those who are unable to fend for themselves. It is, in fact, the only occasion of the kind in the electrical year, at any rate in London. This Institution should fill a great blank in the human organisation of the electrical industry, for it was founded to care for those members of the industry who do not fall within the scope of any other benevolent fund—those who are neither professional men nor members of a trade union; but it cannot adequately fill that gap unless it is provided with adequate funds, and it is the duty of every one of us to help to increase its resources. Those who cannot attend the Festival will do well if they send a donation to the funds; and those who can do neither can still serve the Institution in other ways—if we *all* do a little the future of the Institution is assured.

NEW ZEALAND'S ELECTRICAL DEVELOPMENT.

The Programme for the Future.

Mr. R. W. Dalton, His Majesty's Trade Commissioner, has been good enough to supply the Electrical Review with the following information:—

New Zealand is rapidly becoming of importance, electrically, out of all proportion to the size of her population. The first large scheme to be undertaken was that at Lake Coleridge, as to the possible success of which there was, at the time, considerable variance of opinion. The Government, however, determined to carry out the work, and there is no doubt now that the scheme has been extraordinarily successful; so successful has it been, in fact, that the demand for power in the Christchurch district has necessitated the trebling of the plant, and a still further set is now in process of installation. Further, in order to provide a reserve of water power, the Harper River has been diverted into Lake Coleridge. The success of this scheme has encouraged the Government to develop other and even more important schemes.

The Government is itself determined to control the production of energy, but under its scheme it will allow the formation of Electric Power Boards, which will deal with the distribution of energy supplied to them at sub-stations, for the districts which they cover. It is intended, in the first place, to concentrate on the North Island, and the schemes to be developed are intended to provide the whole of the island with electric power. These schemes are at Mangahao, Waikaremoana, and Arapuni. These main stations form a triangle, the Mangahao station being intended mainly for the Wellington province, the Waikaremoana station for Napier, Hawkes Bay and the east, and the Arapuni scheme for Auckland and the west. The stations will, however, be linked and will form reserves for one another. It was at first intended to develop the Mangahao scheme only at once, but it was afterwards decided to put in a small instalment of the main plant at Waikaremoana and, later still, owing to very strong representations made by the Auckland district, it was decided to develop Arapuni. The contracts for the installation of plant at Waikaremoana and Mangahao have already been let, and the Public Works Department is now at work on specifications for Arapuni.

Similarly to other countries, New Zealand has suffered from the severe depression of the last two or three years, but partly because she is a producer of primary products, she has felt this depression less than most other countries. Nevertheless, she has had to economise very severely both in general government and in other ways. Her public works policy has been very severely cut down, but in spite of that there has been practically no check in the hydro-electric programme. In fact, as has already been stated, this programme has been developed rather than curtailed.

This will indicate the importance which New Zealand attaches to the development of hydro-electricity. The works involved for the completion of all three schemes in the North Island will probably entail an expenditure of close on £20,000,000 before the power is available actually at the door of the consumer. It will therefore be obvious that there is ahead a very important market in New Zealand for all things electrical.

It seemed likely during the war period that American firms, owing to the advantage which they obtained in New Zealand as a result of the war, would be able, after the war, almost to monopolise the business in New Zealand in this branch of trade, which was likely to be one of the most important trades of New Zealand for some years. It is very gratifying, however, to know that since the war American firms have by no means secured the advantage which was threatened; in fact, in the contracts which have already been let by the Government, almost the whole of the plant has been ordered from British firms.

The large British firms have taken very much more interest in the New Zealand market since the war. Two, at least, have opened their own offices in New Zealand, and two or three others have made special investigations in New Zealand. The interests of the manufacturers of the large plant are therefore being well looked after, but there is a grave lack of interest in the market on the part of the manufacturers of small motors and supplies. The demand for these smaller articles is rapidly growing, and when the big schemes are finished there will be a very widely-extended market for these goods. At present, America is still securing a very large proportion of the trade, and some more active steps on the part of British firms are necessary.

To show how urgent the need for active campaigns is, it may be stated that it is hoped that the Mangahao scheme will actually be in operation by the end of 1923, and the other schemes will certainly be pressed forward with a maximum of speed. The completion of all the three schemes will mean the availability of electrical energy at every point in the North Island, and it is

Mr. R. W. Dalton,
H.M. Trade Commissioner in New Zealand, who is now in England.

intended to serve not only the towns themselves, but also the dairy farmers in the "back blocks." In fact, the Government hopes to find one of its largest markets amongst the dairy farmers who, it is contended, will be in a position to use electric power for driving their milking machines and separators, as well as for other purposes.

In addition to the schemes actually initiated by the Government, the plant at Horahora, which belonged to the Waihi gold mines, has been purchased by the Government, and is being considerably extended.

When the North Island is provided for, the Government will be able to pay further attention to the South Island, which is in need of some big scheme to serve the southern portion of the island. In the meantime a licence has been given to the Southland Electric Power Board to erect a plant at Lake Monawai. The intention is, later on, fully to develop Monawai, as the water power available is very large.

Apart from the Government schemes, the municipalities in New Zealand, who were held up during the war and who have therefore been unable to provide for the present demand of their districts for power, are

now developing their own works. In practically every centre in New Zealand electric power is at present very scarce, and in some places it is rationed out with considerable care. Large contracts have already been placed for the development of these schemes, and further contracts will be necessary before the large towns are adequately provided for.

In view of all this development, it is urgently necessary that electrical firms in this country should regard New Zealand, not as a small market with a population of only one and a quarter millions, but as a country with very important electrical possibilities much in excess of what might be indicated by its size. In addition, both the Government of New Zealand and the local authorities are extremely favourable to British goods, and whenever they possibly can they will place their contracts in the hands of British manufacturers rather than foreign firms. Thus the market is favourable from two points of view, first, that there is growing a very important demand, and, secondly, that there is an outstanding preference shown for British goods. Some firms have already realised the advantages offered, and those who have taken an active interest on the spot have secured important contracts. It is hopeless to expect to secure such contracts without direct representation, preferably by a branch house, but if this is not possible, then by the employment of capable engineering agents.

THE HASTINGS ELECTRICITY UNDERTAKING.

RECENT EXTENSIONS.

The Hastings electricity works occupies the unique position of being probably the first undertaking of its kind to commence operation in the United Kingdom, its date of inauguration being March, 1882, since when it has been in continuous use. The original station was installed and worked by the late Mr. Robert Hammond, and the works still occupies the site that was chosen 40 years ago, although little now remains of the original scheme, except the outer walls of the building.

The original plant consisted of Brush series lighting dynamos, which generated electricity at a pressure of 2,000 volts, and were driven through countershafts by under-type locomotive engines. All the arc and incandescent lighting throughout the town was supplied by these dynamos, the incandescent lamps in consumers' premises being arranged in groups of 20 in series, so as to allow the pressure of 2,000 volts to be carried right into the consumers' premises; public street lamps were also arranged in series.

In 1890 the Electric Lighting Co. obtained a Provisional Order, and then commenced to remodel the plant. The series lighting dynamos were replaced by rope-driven Brush-Mordey single-phase a.c. generators, and the distribution system was arranged to supply energy through transformers placed on consumers' premises.

The undertaking was purchased by the Hastings Corporation from the Electric Light Co. on January 1st, 1899. In the first year of successful operation under municipal control the price of electricity was reduced by approximately 25 per cent., thus bringing the price to something equivalent to that charged in other towns, which naturally resulted in a considerable increase in the number of consumers. At this time the plant consisted of three 100-kW and two 220-kW Brush sets, and one 500-kW Parsons turbo-generator. It is interesting to note that this plant is in commercial operation to-day. The Parsons turbo-generator was very successful in reducing the generating costs, its steam consumption being 22 lb. of steam per kWh at full load. Some idea of the great progress that has been made in turbine plant during the last 20 years can be obtained by comparing the steam consumption of this set with that of the Brush-Ljungström turbo-alternator which forms part of the present extension—namely, less than 13¾ lb. per kWh.

The boiler plant consisted of three Babcock & Wilcox land-type boilers and two marine type; the marine boilers were equipped with Green's economisers, but owing to the lack of available space these were not used with the land-type boilers.

The rapid growth of the undertaking was made the subject of a report by the borough electrical engineer, Mr. Russell F. Ferguson, to the Electricity and Public Lighting Committee in January, 1921, an immediate extension of plant being of vital necessity; sanction from the Electricity Commissioners having been obtained for carrying out the work, tenders were accepted by the Council on August 5th, 1921, but as no alteration could be commenced before the winter peak load was over, the contractors did not start work till the end of February, 1922.

The present extensions, the official opening of which was performed by the Mayor, Ald. W. J. Fellows, J.P., on November 8th, include a 1,125-kW Brush-Ljungström turbo-alternator, fig. 3, with steam at 170 lb. per sq. in. at the turbine stop valve, 475° F. total steam temperature, and exhausting into a vacuum

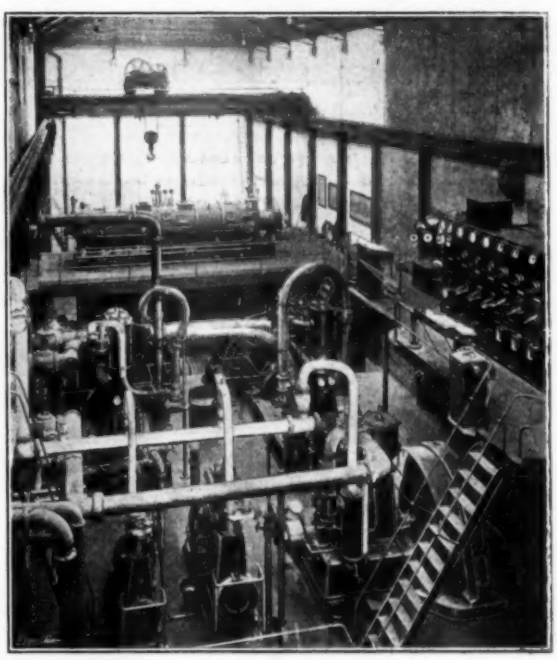


Fig. 1.—Generator Room at Hastings.

of 28 in. (bar. 30 in.). The set has an overload capacity of 25 per cent. for two hours, and runs at a speed of 3,000 r.p.m. The two alternators operate in parallel, and are wound for a combined output of 1,125 kW. 2,000 volts, single-phase, 100 periods, at a power factor of 0.9. The turbo-alternator is mounted on a Brush surface condenser, which has a cooling surface of 2,500 sq. ft. and a capacity of 15,350 lb. of steam per hour, and is capable of maintaining a vacuum of 28 in. (bar. 30 in.); 2,300 gallons per minute of cooling water at 80° F. are required. The cooling tubes are ¾ in. diameter and 12 ft. long, the condenser containing 1,070 tubes. The auxiliaries of the condenser comprise a three-throw Brush-Edwards air pump 12 in. diameter

by 10 in. stroke, running at 120 r.p.m. A lift pump is driven off the air pump crank shaft for pumping the condensate to the hot well. The air pump is driven by a Bumsted & Chandler 9-b.h.p. single-crank, non-compound, double-acting, forced-lubricated engine running at 600 r.p.m. This engine works under the same steam conditions as the turbine, and is capable of delivering the power required when exhausting against a back pressure of 10 lb. per sq. in. above atmosphere. The alternators are provided with a duplex-type exciter shunt-field regulator mounted on the front of the switchboard gallery, and fitted with concentric hand wheels. For filtering the cooling air to the alternators, a Cleworth, Wheal wet air filter is provided. It is driven through gearing by a 1-h.p. 100/110-volt d.c. motor, and is connected to the alternators by means of sheet-steel ducts.

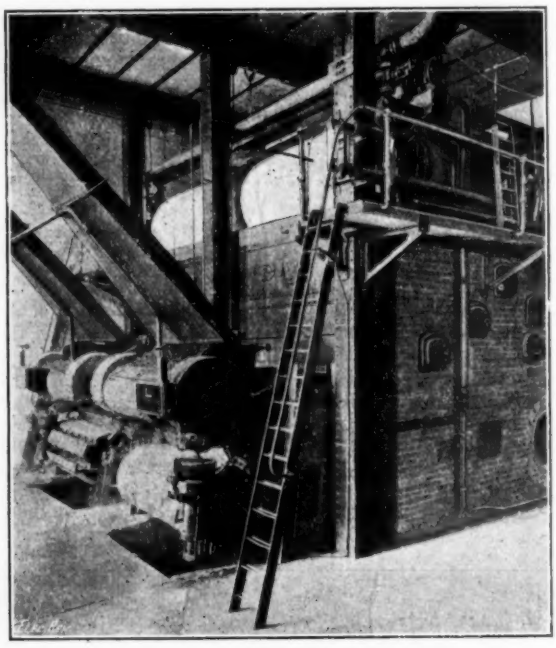


Fig. 2.—Stirling Boilers.

The boiler plant, fig. 2, was supplied by the Stirling Boiler Co., Ltd., and consists of two boilers, each boiler having 255 main tubes, 3¼ in. outside diameter, the heating surface being 2,644 sq. ft. The total length of 3¼ in. tube in the boilers is considerably in excess of one mile. The total heating surface of the boilers is 5,288 sq. ft., and is remarkably great for the space occupied, namely, height 19 ft., width 20 ft. 3 in., depth, back to front, 20 ft. Each integral "U" type superheater has an effective heating surface of 175 sq. ft., and is situated immediately behind the front bank of water tubes. The headers are at the top, and the header caps are out of contact with the products of combustion. The working pressure for the plant is 180 lb. per sq. in., the steam being superheated 100° F. The rated evaporation per boiler is 10,000 lb. of water per hour, but this may be readily exceeded.

The mechanical stokers are by the Underfeed Stoker Co. They act under a combination of forced and natural draught; the grate surface of each stoker is 57 sq. ft., and the normal coal consumption per grate 12 cwt. per hour. The coal is stored in hoppers in front of and above the boilers, it is fed to the stoker hoppers by chutes, and is regulated by duplex coal valves. Lea coal meters are fitted to and driven by the mechanical stokers. The boilers are fitted with the usual Dewrance mountings, but, in addition, Crosby automatic feed-water regulators are fitted.

The "Mon'lithcrete" floor over the new boilers is an extension of the old coal store, and has a capacity of 500 tons of coal, the mechanical stokers being fed from this floor by hoppers. The flat roof supports a 10,000-gallons Fawcett reinforced concrete water tank, upon which is mounted the cooling tower.

So far as was possible local labour was employed. Messrs. Hayhurst & Wright, of Hastings, as sub-contractors of the Fawcett Construction Co., Ltd., executing the whole of the general builders' work. All the pipework in connection with the turbo-alternator, condensing plant, and cooling tower has been manufactured and erected by Messrs. Aiton & Co., Ltd., of Derby. The steam and feed-water piping is made from solid drawn tubing, the flanges on the steam pipes being welded on electrically by the carbon-arc process, the feed-water pipe having flanges screwed on. All branches are welded to the main pipes. The blow-off, auxiliary exhaust, and air pump discharge pipes are manufactured from lapwelded tubes with flanges screwed on and branches welded. The whole of the circulating water pipes and the main exhaust pipes are made up from mild steel plates, all joints and flanges being electrically welded. The blow-off tank was also made up from mild steel plates, with electrically welded joints, this tank afterwards being encased in concrete.

The cooling tower, by the Premier Cooler & Engineering Co., Ltd., was specially designed to suit the restricted space available on the power station roof, and is capable of reducing the temperature of 130,000 gallons of water per hour from 99 to 80° F., when the air temperature is 55° F., and the humidity 75 per cent. The tower is designed primarily for forced draught, but special provision has been made for operating on natural draught at light loads; under forced draught conditions the air to the cooler is supplied by two steel-plate fans 9 ft. in diameter, mounted on one common

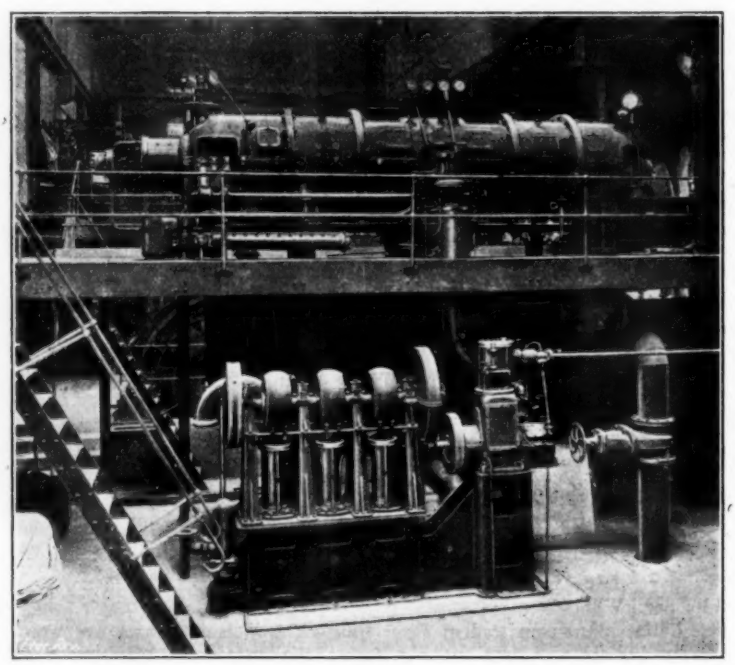


Fig. 3.—Brush-Ljungstrom Turbo-Alternator and Condensing Plant.

shaft, and driven by a high-speed engine of Messrs. Bumsted & Chandler's make. The fans are of the propeller type, absorbing at the shaft under normal conditions not more than 24 b.h.p.

In conclusion, it may be said that during the year 1922 the energy generated amounted to 1,947,769 kWh, the total maximum demand being 1,082 kW; the total connections amounted to the equivalent of 136,111 30-watt lamps, and the total number of consumers was 4,005. The average length of service of six of the members of the staff is 33 years; the station superintendent has been with the undertaking since its commencement in 1882, and the average length of service of 13 of the workmen employed is 26 years—an excellent record.

The extension was opened in the presence of a large gathering by the Mayor's turning on the main steam valve. It was stated that the extension had been carried out within the estimate of £51,000, and it was explained that the scheme was only a makeshift pending the construction of a central station for the supply of electricity in bulk to the town and district. If the present demand continued, the station could only last for a few years, and the hope was expressed that Bexhill, Battle, and Rye would arrange to take a supply from a central station at Hastings.

THE HOMECOMING OF ELECTRICITY.

By J. W. BEAUCHAMP, M.I.E.E., Director and Secretary of the British Electrical Development Association.

(*Concluded from page 737.*)

Methods of Charging for Electricity Supply.—This particularly fascinating subject has held the attention of the electrical engineer from the beginning of the public supply of electricity; commencing probably with the classic investigations of Wright, it has developed into a science intimately bound up with the economics of generating and distributing electricity, and the investigations made upon it have thrown a most valuable light upon the underlying principles of charging for most services and commodities.

It has been argued by some that we have obscured the whole subject by too much scientific treatment, and that the best thing we could do would be to import into the business an outside commercial expert who, unhampered by detailed knowledge of our basis of costing and of our past tariff history, would immediately evolve some simple and attractive method of charging which would revolutionise the business.

It is by no means certain that this would really be the case. One can imagine that a Selfridge, asked to devote his attention to the commercial side of the electrical industry, would in a short time become so fascinated with its characteristics and with the precise and illuminating way in which electrical engineers are able to ascertain the cost of this or that supply that so far from undoing our work and presenting us with some magic method of selling, he might rather return to his own field of activity and endeavour to introduce multi-part tariffs into the commerce of silk stockings or food! or, at least, go back with the fixed intention of applying many of the electrical engineer's methods of analysis to his own business.

The period of ten years before the war was notable for the activity of tariff builders; it saw the work of the "point fivers" and the growing activity of those who perceived the great future of electricity supply. At one time we had reached the stage when a well-known and most energetic supply manager boasted that his tariff list contained such a number of different forms of charge that it was impossible that any potential user of electricity could fail to find one of them suitable and attractive to him.

We have gone a long way since then, and now the movement is all in favour of simplicity.

The increase in the use of electricity for power has helped very much; methods of charging for large industrial supplies have crystallised around the maximum-demand system, collecting a fixed charge per annum in relation to demand and a further charge for the kilowatt-hours used, generally in association with sliding scales on coal and other variables.

We are now in the process of adapting these methods to domestic supply, and already some half-a-dozen comparatively simple and attractive tariffs are struggling for supremacy in this direction.

The method devised a long while ago by Mr. Long, of Norwich, is perhaps in most extensive use in this country, and is still extending; in spite of certain drawbacks, it has the merit of extreme simplicity, and appeals to the non-technical user.

It is probable that with modifications to overcome risk of trouble due to change in the rateable value of premises, varying often rather widely from their electrical needs, this system will extend considerably, or at least run closely with the "assessment" method, where the fixed charge is based upon capacity connected, or the Dundee "floor area" method, which has distinct advantages.

Broadly, there appears to be a growing tendency to insist upon an annual fixed charge, to associate it with normal lighting requirements, or at least with the value of the account for normal lighting under present circumstances, and in addition to this to handle all the cooking, heating, and other applications by means of one, or perhaps two, running rates per kilowatt-hour.

Engineers are being confirmed in the principle of fixing their subscription charge on lighting requirements by growing experience of the very high diversity of other uses of electricity in the home.

It is interesting to remember that when gas was first supplied in a public way it was sold on the contract system for lighting at some small rate per burner per year—a burner at that time being something of the nature of a pin hole in an iron pipe.

The gas people have found their problem simpler because of their ability to store gas—to make it at a steady rate and yet be able to deliver it at a fluctuating rate to suit users' needs. Whether they will continue in this happy position remains to be seen; already it is stated that in some large cities the gas cookery peak is so heavy on Sundays as to need the firing-up of a few extra retorts, and the consumer fluctuations are beginning to outstrip the capacity of the gas holders.

The problem appears to have arisen also in certain parts of the new world where natural gas is supplied, the cost of the gas being small compared with the expenditure on storage and distribution.

Here gas has been sold, particularly in large quantities for operating central heating boilers, on a multi-part tariff, an initial charge being made in accordance with the maximum rate of use, and in some cases also a service charge, then in addition the gas is sold at a rate per cubic foot.

There can be no doubt about the fairness of these methods of charging; the only problem before us is to make them sufficiently simple in practice and to base our calculations rather upon averages than upon individuals, to regard a street of houses as a group, and to look at maximum demand on feeding points rather than on individual terminals.

One thing at least has emerged from the work of recent years—that the straight contract system is no solution of the problem; in the past we were frequently reminded of the general use of electricity in small houses

on the Continent, that in such cases meters were not employed, everybody was well pleased to buy the light at some small rental per week or month; but investigation showed that in many of these cases it was impossible for the consumers to obtain any other kind of light from a central source, electricity could only be replaced by oil or candles. Moreover, having been used to these crude methods of lighting, the people accepted an indifferent, fluctuating, and roughly installed system of electric lighting with a satisfaction which they would certainly not express in this country, where in most places a good gas supply is always available.

The growing use of electricity for heating and other purposes, and the increasing understanding of it by the people, has made it almost impossible to offer an unrestricted supply, as is done in the case of water; excluding gross waste, the water requirements of a household are well defined, although here again as the populations increase and the use of water grows with the freer installation of baths and other conveniences, it seems possible that the authorities may have to reconsider the position. But in the case of electricity, it becomes so easy to convert it into power or heat and use it in many convenient ways, even for the purposes of small trading, that to give an unrestricted supply for a fixed charge is likely to prove a disastrous policy and to be inequitable as between one user and another.

A multiplication of meters we do not want, but apparently for a long time to come tariffs must centre around the use of at least one unit-recording meter. If we are able in this way, particularly as electricity areas extend and linking-up is carried out, to operate a single and uniform flat rate for the kilowatt-hour over large areas, and to secure adequate payment for differences in distance and density of demand by means of varying fixed charges, we shall be well on the way to a tariff which will be safe for the undertaking and satisfactory to the user.

Generally in the making of tariffs, particularly where the domestic load is to be encouraged, the temptation to reduce lighting rates or charges made in relation to lighting should be resisted; people will pay a fair price for electric lighting to-day, and that fair price should be secured. To make a lighting rate 1d. or 2d. lower than it really need be does not benefit the business, but may restrict its development by rendering it more difficult to obtain funds for the development of mains, the carrying-out of "service work," and the offering of a low and competitive rate for heating and cooking.

We have as data our known costs of supply, and the fairly well-known costs which would be achieved if the supply were to develop in this or that direction; these act as a general guide in tariff making, but the real indication comes to us from the rates charged for competitive media, fuel and gas. In short, we must give more and more attention to the value of the service rendered, keeping lighting charges fairly well up and depressing heating and power charges, and with regard to power it is well to bear in mind that the value of electric power to the user depends upon what he does with it and the relative position which his power bill occupies in his total cost of production.

There are districts where people to-day are paying 6d. a unit for electric power; there are others where they can perhaps ill-afford to pay 1½d. for some purposes, and yet for others find the supply cheap at 4d.

It is not easy to meet all these conflicting conditions, but they are worthy of the closest consideration, and the tariff makers should never forget that there are only a very few cases where extremely cut rates for electricity are necessary; in connection with most of its applications it is far more essential to provide ample service facilities than to cut the rates. A fairly competitive tariff, plus good service facilities, will bring business anywhere—a very low rate without service facilities may result in no development at all.

In the meantime these problems to some extent tend to solve themselves where energetic measures are taken; more attractive tariffs improve the load curve—improvement in the load curve makes it easier to frame tariffs, and may even bring us to a stage where we can simplify the best of our present methods.

The last two years have seen an improvement in the position with regard to tariff making, largely as a result of the work of the British Electrical Development Association and the very sympathetic assistance which has been given to it by the Electricity Commissioners.

Already Grimsby has obtained powers to approach the Commissioners with forms of compulsory multi-part tariffs, and the latest Electricity Bill also contemplates and provides for wider variations in methods of charging than have yet been possible.

It does not seem too much to hope that another two or three years will see many desirable changes, and a much wider use of the multi-part tariff, particularly if its advantages to the consumer can be supported by relatively high maximum flat rates; there can be no doubt that if the authorities become seized with this idea and meet the desire of the industry by keeping up the statutory maximum flat rates, there will be a great growth in the use of the multi-part tariff, and of special night rates for off peak load and similar facilities so desirable at the present time.

Throughout the whole history of tariff making we have from time to time run up against the "business man," on a municipal committee or board of a supply company, who fails to perceive why electricity should be sold at more than one price; arguing that it is the same electricity that lights a lamp or cooks a steak, he demands that cost should be divided by units and everyone charged on the average resulting. A year's experience of this method would probably surprise him and effect some extraordinary changes in that average price.

Vexatious as these discussions are, they have done much to spread knowledge of tariff making and the underlying basis of supply economics which, after all, are very similar to those which rule other businesses, even if they are not recognised as doing so.

One must hope that this subject will continue to be as attractive to engineers as it has been in the past, and it would not be too much if the Institution were to call for one paper per year on electricity tariffs. There are still plenty of members particularly well able to produce good papers on this subject or write books upon it; there is need for a thorough graphic, if not mathematical, analysis of the whole subject, bringing it up to date and showing the relation between the various simple tariffs dictated by expediency, and the underlying principles upon which they are constructed.

Pre-occupations of the Engineer.—At the present time when commercial development of the electrical industry is interesting a great many people, many of them not particularly well acquainted with its past, it is desirable that one should keep in mind the history of the business and the place which the engineer and his assistants have filled in it successively for thirty or forty years.

Our actions and mental attitude towards life and work are largely influenced by experiences met upon the road by which we have travelled.

In the early days, and for many years after the introduction of the public service of electricity, engineers were concerned with the technique of the business; they were obliged to work closely with the manufacturers of plant and material, and discover gradually how difficulties could be overcome, only to encounter new difficulties as the business grew.

Their work was a mixture of design, or the criticism of design, and the adaptation of inadequate plant to new conditions, and they were obliged to regard not only the generating station, but the distribution network, and even questions of wiring and appliances for consumers' use.

Later as business grew and widened they were confronted with a variety of problems concerning administration, accountancy, management of staff, and all the involved questions of remuneration and working conditions which were brought to a head by the war, and

which happily to-day may be said if not to be solved, at least to have been brought out of chaos into something resembling a system.

Still later the attention of supply management has been distracted by political considerations, national and local; much time and energy has been expended on dealing with proposals for the unification of electricity supply, warring interests have claimed thought and labour which under simpler circumstances could have been devoted to the development of the business.

Over the whole period the managing engineer has been obliged to give attention to the relation between the financier, generally a layman, and the industry; whether working for a board of directors or a municipal body, he stands in the dual position of servant and adviser.

However, after many years during which the engineer has been in the position of building his boat whilst it rushed through rough waters with ever-increasing speed, it does at last appear that a clear line of action is emerging; slowly the various branches of the business are crystallising out. It is recognised that the commercial and technical sides must to a great extent be separated, although under single executive management.

There are now groups and associations representing manufacturers, contractors, and the different sections of the supply industry, dealing with technical, legal or administrative matters, and more recently paying attention to trade conditions and to propaganda; all these bodies to-day are stronger and more respected than ever before; there is also between them a growing sense of common interest, and it seems obvious that if nothing occurs to disturb the economic life of the country, we shall within a few years have the satisfaction of belonging to the most valuable, the most powerful, and the most widely appreciated of all the public services.

PROGRESS IN ILLUMINATING ENGINEERING

The opening meeting of the 1922-23 session of the Illuminating Engineering Society was held on November 14th, Mr. W. R. Rawlings presiding. This was the first occasion on which the Society had met since the redecoration of the premises of the Royal Society of Arts, and much interest was evinced in the lighting of the hall, which has been considerably modified. A new feature is the removal of the frescoes on the ceiling, which is now white, and the main lighting is effected by four pendant semi-indirect units, using alabaster bowls. Improved arrangements have also been made for the operation of the lantern, and an ingenious device has been provided to enable the central dome skylight to be more or less curtained by the lantern operator.

As is usual at the first meeting of the session the Illuminating Engineering Society devoted the evening partly to reports of progress and partly to the exhibition of novelties. Mr. L. Gaster, in his review of events during the vacation, made special reference to the contents of the third report of the Departmental Committee on Lighting in Factories and Workshops. He explained that the original scheme of the Home Office Committee had been somewhat curtailed owing to the demand for national economy, and it was therefore essential that its aims should be fully understood. It was hoped to arrange for papers to be read before several scientific societies and trade associations, with a view to making these aims more generally familiar. Reference was next made to the report of the Miners' Nystagmus Committee which had fully endorsed the view taken at the Society's discussion in 1920 that inadequate lighting was the main cause of this disease. The work of the Committee had given a great stimulus to the design of improved miners' lamps. Street lighting was another subject that had been exciting some attention, improvements having been made in various thoroughfares in London, and the relation of lighting to accidents was being studied by the London "Safety First" Council. Investigations in the United States had led to the conclusion that over 17 per cent. of the accidents occurring at night were due to inadequate lighting. It was intended to devote a meeting of the Society on December 12th to a full discussion of street-lighting problems, and the co-operation of other bodies interested would be welcomed.

Mr. Gaster also referred to the large number of papers on lighting presented at the annual convention of the American Illuminating Engineering Society in September, and mentioned the use of "artificial daylight" in the Milwaukee Art Gallery as an interesting development. The co-operation of architects in lighting matters was highly desirable, and the Royal Institute of British Architects had recently published a summary of the discussion before the Illuminating Engineering Society on "The Lighting of Public Buildings" in its official organ. A paper dealing with various aspects of illumination was also to be read before the R.I.B.A. on November 20th. In conclusion, Mr. Gaster mentioned that a Special Commission on Illuminating Engineering had been formed by the Central Electrotechnical Council in Russia.

Mr. J. W. Elliott then presented a report by the Committee on Progress in Electric Lamps and Lighting Appliances. He pointed out that the cost of lamps had been materially reduced during the past year. Another step of importance was the introduction of 100/130-volt, 30-watt and 200/260-volt, 40-watt gasfilled lamps. Gasfilled lamps with opal bulbs were proving very acceptable for shop-lighting, and "daylight" lamps, giving a spectrum closely approximating to daylight, had proved convenient for industries where colour-matching was of importance. A third line of development had been the improvements in gasfilled projector lamps for kinematograph work, flood lighting, &c. Lamp manufacturers were now in a position to meet all demands without drawing on foreign supplies of raw material. Makers of fittings were working in close co-operation with lamp makers, and there was now a wide variety of shades and reflectors available. In this field a novel development had been the introduction of bowl fittings having a clear glass canopy all moulded in one, so as to be practically dustproof, and thus eliminate the greatest objection to the open bowl.

The remainder of the evening was occupied by demonstrations of various novelties in the lighting field. Captain E. Stroud exhibited a new form of illumination-photometer which has some interesting features. The whole apparatus is in the form of a tube, within which the dry battery is concealed, a small ammeter being mounted at one end of the apparatus and the observation tube at the other. Observations are made by the aid of a modified Lummer Brodhun tube, and measurements of brightness, as well as illumination, can readily be made. The instrument was devised by Mr. D. H. Tuck. Captain Stroud also showed a new product of the Holophane Laboratory, the "Filterlite" fitting, which is a totally-enclosed semi-direct unit having a bowl divided into three distinct areas, giving a soft and pleasing effect.

Mr. Hobson then showed the latest development in the hospital inspection lamp devised by Mr. J. B. Reiner, which has now assumed a very portable and compact form. The lamp is the outcome of experiments in which leading ophthalmic surgeons and members of the Illuminating Engineering Society have taken part, one of the chief difficulties to be overcome in this form of lamp being the formation of a clear spot, of high and even brightness, by the action of lenses in front of a metal-filament lamp capable of being run off an ordinary supply. The lamp is expected to be of great value in eye hospitals.

Mr. W. Plummer demonstrated the latest type of "Ceag" miners' lamp, in which a material improvement in the distribution of light has been secured, owing to the absence of the obstructing pillars. Another feature is the use of an adjustable reflector, by means of which the filament can be screened at will and the light concentrated in any desired direction.

Mr. S. O. Pearson gave an interesting demonstration of the "blinking" of neon lamps, when shunted by a condenser; by adjusting the electrical characteristics of the circuit very wide variations in the flashing period can be secured, and the device may prove useful in connection with luminous signs.

Mr. E. T. Ruthven Murray showed some developments in his form of luminous sign, consisting of designs or lettering stencilled on the back of plate glass and illuminated by tubular lamps at the top or bottom. Designs in gold or colours can now be executed and made to "stand out" brilliantly illuminated. Several neat designs, suitable for use with ascending and descending lifts, one showing the actual position of a lift in a multiple-story building, were included in these exhibits.

Captain W. J. Liberty gave a brief description of the lighting of the new Port of London Authority's building, illustrating his remarks with a series of photographs, taken by Mr. J. S. Dow exclusively by the actual light in the rooms. Most of the rooms utilised alabaster semi-indirect bowls, the walls being panelled in dark wood, with highly ornamental carving.

Other items included the exhibit of some "Fullolite" lamps in "Astro" intensifiers and the demonstration by Mr. Chas. Selzz of a method of impregnating silk lamp shades, so as to obtain better translucency, freedom from prejudicial effects of dust, and comparative protection against fire.

What is a Volt?—According to the *Bulletin* of the Hydro-Electric Power Commission of Ontario, the following curious definition recently appeared in a Toronto daily paper:—"There were six holes in a brick wall, through which entered, passing along copper wires encased in pipes, 26,000 units of power. They are called 'volts,' and volts means leaps or bounds. 'Leaps' of power; but the bounds are so speedy that practically the power pressure may be said to be unbroken in the direct current."

THE MORWELL POWER SCHEME.

By H. R. HARPER, Chief Engineer, State Electricity Commission of Victoria.

Speaking as an engineer engaged in the task of providing for the electrical needs of a State, I think I cannot do better in sending a message to engineers, whether at home or abroad, than to remind them of the great evolutionary changes that have taken, and are taking, place in the scope of the great public utility in which we are all interested, namely, electric supply.

There are many of us engaged in this industry who are mindful of the struggles to establish electric supply undertakings in the '80's, when light was the only field for exploitation, opposition was keen and determined, the outlook was extremely circumscribed, and little or no encouragement was forthcoming from the Legislature.

Since those days of narrow vision and application, the business of electric supply has developed into a key industry, serving the needs of the community for light, heat and power in every department of life.

No longer can it be considered as belonging solely to the category of purely municipal functions. The demand for power for industrial purposes and for main-line electrification is a factor which is tending to break down municipal boundaries within which we were prone to believe electric supply could only properly function. The generation and transmission of electricity is no longer the sole prerogative of the borough council—it has become the concern or responsibility of a greater authority. It is therefore incumbent upon engineers of supply undertakings to encourage the taking of broader views in providing for the requirements of the future and to remember that municipal rate aiding is of much less importance than the ever-widening distribution of cheap energy for industries, transportation, &c. Further, the national need for the highest efficiency in the production as well as distribution of electricity calls for the abandonment of the idea that the requirements in each municipal area are necessarily best served by a plant whose operations are confined solely to such area. To obtain the best results to-day, generating plants require to be favourably situated with regard to coal and water supplies, and to be of the largest capacity commercially attainable. With high-pressure transmission lines, such plants may be capable of serving the needs of more than one municipal area, and should certainly be designed to meet the requirements of railway electrification and essential industries, both of which are outside the province or scope of any one municipal body.

The Board of Trade Report (1919) on the Electric Supply Industry was the first important step towards the realisation that the industry was of national importance, and had grown beyond its municipal limitations. In this report it was proposed to divide the United Kingdom into a limited number of districts, each to be governed by a representative District Electricity Board, which was to have had conferred upon it the functions to generate and transmit electricity to existing distributors, railway companies, essential industries, &c. It seems a matter for great regret that public opinion was so ill-informed, or municipal opposition was so great, that this great opportunity of reorganising the industry upon national lines was lost. However, there may be other ways of arriving at the same objective, and it is to be hoped that the proposal that the various supply authorities in a given district should voluntarily associate themselves into a joint authority for the production and transmission of energy will place the industry upon a basis productive of the highest efficiency.

It was with a similar objective that the overseas Governments of New Zealand, Ontario, Tasmania, and Victoria embarked upon their national schemes of generation and transmission. Three of these States are harnessing the water-power resources, of which each has an abundance, while Victoria is launching a scheme for power production by the utilisation mainly of her extensive and cheaply operated lignite measures, considerable information with regard to which has already been conveyed to readers of the Review. The State Government has constituted itself the sole producer of electrical energy, and has created a Commission to undertake the establishment of power houses and the construction of transmission lines to convey the energy not only to the capital, but to other centres of population in the State. In carrying out this task, the needs of the country districts are not being overlooked, it being the desire of the Commission to make available to such districts a convenience which, up to the present, has been enjoyed only by the town or city dweller. This has been made possible by the fact that the Government of the State owns an enormous deposit of lignite situated at Morwell, 90 miles from Melbourne, which will satisfy the needs of the State for many hundreds of years. This is one of a number of similar deposits situated in various parts of the State, and their efficient utilisation for power and heat purposes should not only ensure the prosperity of this part of Australia as a great industrial centre, but also make the State self-contained in the supplies of fuel for its own purposes.

The State itself will be a large consumer of its own energy, for the railways, both suburban and country, belong to the State. The suburban (Melbourne) railways have already been electrified, and with cheap power available, it will not be long before electrification will be extended to the country lines.

The fact that the Morwell lignite deposit averages about 174 ft. in thickness, with an overburden of about 30 ft., makes it possible to win the fuel for the power house which is being established on the field at what will seem a remarkably low cost, *viz.*, about 2s. 6d. per ton. This will result in a very low variable charge in the energy production cost, *viz.*, 0.053 pence per kW-hr. generated at the power station for fuel, water, coal and ash handling, &c. Of the total cost of energy production, the standing charges, including capital charges, maintenance, &c., at the power station, will amount to about 80 per cent. Hence, from a cost point of view, the State scheme will resemble a hydro-electric system, and the low variable charge will make it possible to transmit the energy considerable distances with economy. Already one branch transmission line—120 miles long, 44,000 volts—is being constructed to carry a load as small as 1,500 kW to a country district, and lines in other directions are under consideration for similar purposes. In the first stage of the main scheme, about 50,000 kW will be transmitted to Melbourne at 120,000 volts, and when stepped down to 22,000 volts at the terminal station, it is estimated that energy at this voltage will be available at about 0.48d. per kWh for a 42 per cent. load factor. For industries requiring large blocks of power of high load factor, facilities will be granted to enable them to settle near the Morwell power station, where 100 per cent. load factor energy could be made available at about 0.18d. per kWh at the power station busbars.

Provision has been made for ready extension up to 150,000 kW at Morwell, and when the demand exceeds this, power stations can be established on the same lignite deposit, or on other fields up to any capacity that the future may require.

The geographical situation of Australia is such that, provided her population increases rapidly, she must learn to manufacture not only the majority of her wants, but some of the wants of the vast multitudes in the East. There is every indication that immigration is going to be accelerated. Consequently, the electrical developments of Victoria during the next decade promise to be on a very large scale, and with cheap and adequate power available, the industrial future of the State is assured. This is a point not to be overlooked by British manufacturers who may be considering the establishment of branch works in the Commonwealth.

A CATHODE-RAY OSCILLOGRAPH.

The cathode-ray oscillograph, which was demonstrated on November 16th by Mr. R. Webb (for the President) at the Institution of Electrical Engineers, comprises a vacuum tube, at one end of which the cathode rays are generated, striking a fluorescent screen at the other end, on which they appear as a sharp green spot. The electrons for the rays are provided by a heated oxide-coated filament.

The anode is a small metal tube placed immediately in front of the filament, and is raised to a positive potential of 300 V with respect to the filament by means of a battery of dry cells. The electrons from the filament thereby acquire a considerable velocity, and some of them pass completely through the tubular anode, and fall on the screen. The rays, before reaching the screen, pass between two pairs of parallel metal plates set at right angles to one another. If the two plates of either pair are not at the same potential, the rays will be deflected in a plane perpendicular to the plates by an amount proportional to the difference of potential. If an alternating difference of potential be applied, the spot on the screen will be drawn out into a line. The rays can also be deflected if a pair of parallel coils be mounted outside the tube and a current be passed through them in series. The deflection will be proportional to the current.

It will be seen that this tube is a modification of the original Braun tube used in the experiments to determine the ratio e/m for the electron. It has the advantage that it can be

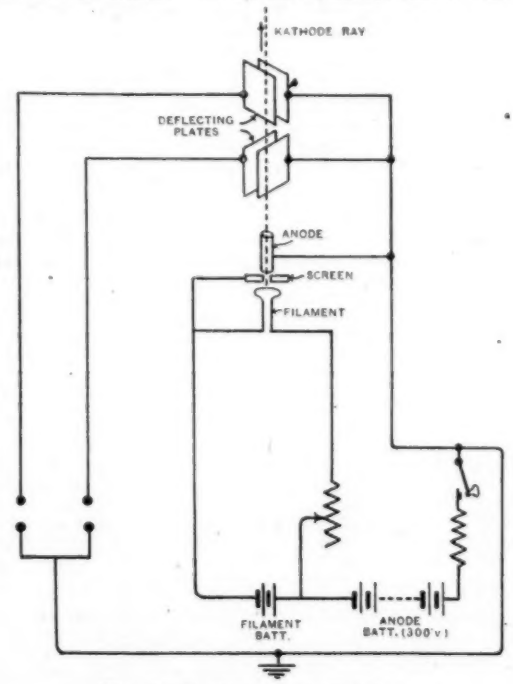


Fig. 1.—Diagram of Connections.

operated at 300 V instead of about 30,000 V as in the original tube, with the result that the rays are slower and can be more easily deflected.

The tube was used to show the characteristic of a thermionic valve. The valve was set up as an amplifier and a low frequency interrupter was connected through a transformer to the grid. The difference of potential between the grid and filament was applied to one pair of plates of the oscillograph, and the anode current was passed through the deflecting coils. The other two plates were short circuited together.

The two deflections were so arranged as to be at right angles, and as they were proportional respectively to the grid voltage and anode current of the valve at any instant, the fluorescent spot traced out the grid voltage anode current characteristic of the thermionic tube when the interrupter was switched on. The effect on the characteristic of a change in the anode voltage of the valve was admirably demonstrated, the curve changing progressively as the anode voltage was changed.

The oscillograph tube can be applied to many other purposes, among which may be mentioned the following:—Examination of wave form of generators of all kinds; accurate comparison of two frequencies; investigation of iron hysteresis; investigation of the extent of modulation in radio telephony; and measurement of nerve reactions.

The main advantage of this form of oscillograph over other forms of electro-dynamic oscillographs is that there is no appreciable inertia in the rays so that the tube can be used without introducing distortion up to the highest frequencies. By adjustment of the current which heats the filament, the spot can be sharply focused; and the effect can be photographed.

THE THEORY AND PRACTICE OF SALESMANSHIP.

The series of salesmanship lectures organised by the Electrical Development Association entered on a new phase on November 17th, when Mr. Wallace Attwood, an expert trainer of salesmen, gave the first of three lectures on the theory and practice of salesmanship in relation to the electrical industry. Mr. A. F. Berry, of the British Electric Transformer Co., Ltd., presided, and there was again a good attendance.

Mr. Attwood said that his first lecture would endeavour to lay bare the elementary principles, with examples from the electrical industry, the second lecture would deal with creating new avenues for business, and the third lecture with managing the interview. He explained by means of charts the relationship between the manufacturer and the public through the medium of the salesman, the repair staff, meter readers, account collectors, and wiremen, and showed in a simple manner how the interests of everyone connected with the supply of electricity and the manufacture and installation of apparatus were bound up together. The point he stressed considerably was that, whether it was electricity or apparatus, what was being sold was service, and that the customer must be spoken to in terms of service, and not in terms of price or apparatus. Incidentally, he urged that all those who came into contact with the customer should be encouraged to talk about electricity and, as an example, he mentioned that the meter readers alone could speak and make known the advantages of electricity to millions of people every year if they made it a practice to talk to only a few of those with whom they came into contact during their calls. That would be sowing seed, and much more of this was wanted. He added that a great deal of the fog in his mind as to electrical apparatus had been cleared away as the result of a chat he had had with Mr. Berry, and his desire to possess electrical apparatus had been awakened.

The lifeblood of the electrical business was business building, and not business getting. There was a great difference between the two, because it was necessary, not only to get business, but to keep it, in the shape of repeat orders. He did not think the electrical industry had yet fully appreciated that. They seemed to think that it was good enough to have good stuff, but they were not alone in that respect. He did not believe in the theory that good goods would sell themselves; they would not, and the position in the electrical industry at the moment was that they were not "making known" to the public sufficiently, and when they had made the selling side as efficient as the manufacturing side the public would appreciate it all the more. Selling was very largely a matter of persuasion, but to bring that into full effect it was essential that the salesman should thoroughly study human psychology, because 80 per cent. of selling was handling the other man, and very few salesmen had given this aspect of the question much thought. They handled their customers in an intuitive manner, many of them quite successfully, but they could not explain how they did it, yet it was possible to organise selling scientifically. He did not agree that salesmen were born and not made. Salesmanship was being taught, although it was necessary that the person being trained should have a liking for the work in the first place. In a discussion of the laws of persuasion Mr. Attwood repeated that good salesmanship was selling on service and not on price, and the latter should always be kept in the background as long as possible. He took as an example an electric cooker costing £18. If a customer was told the price at the beginning he would probably say it was a big one, but if the service of the cooker was emphasised and explained the customer would gradually have less regard to the price, and come to think that he would rather have the cooker than the £18. That was the ultimate aim to have in view. No man bought a cooker or any apparatus because it was a piece of apparatus, but because of the service he hoped to get from it; salesmen should, therefore, speak to customers in terms of service, and not of price. At the same time, the mistake should not be made of talking the customer into a sale and not clinching it before he had been talked out of it again.

Detailing the steps by which a salesman should proceed, he said it was first necessary to rivet attention, then to arouse interest, next to create desire by appealing to the imagination, and then to effect the sale. In this connection he urged that the deal should be a square deal; the real objective was not selling, but to make the customer appreciate that he could make money by buying any particular piece of apparatus, or could get some advantage out of it—in the case of electric cooker in the shape of greater cleanliness and comfort, for instance. The country was over-run with 19th century habits, and the biggest difficulty of the electrical industry was to change these habits. It was a big job, and was largely a mental problem, and that was why the successful salesman must make a close study of human psychology and also be human himself. The objective of the E.D.A. was, he understood, to place the whole business on a higher plane, and until they raised the plane upon which selling rested it would not be regarded as a profession. Unless that were done they would not get the revenue, and consequently the profits, that were possible from the capital and brains that had been put into the industry.

In the subsequent lectures Mr. Attwood said he would give some concrete examples to illustrate the points he had made in this preliminary lecture.

In the discussion which followed

Mr. W. A. Gillott said there must be service if there were to be repeat orders. If they sold a man a cooker and did not back him up with a good maintenance service they could not expect repeat orders.

Mr. W. E. Warrilow asked the lecturer to say how he would get over the difficulty of a salesman having to get at his man through the small window of an inquiry office, as was too often the case. The salesman might hand his card in, but he could not get at the buyer.

Mr. E. Sharp differed from the lecturer in saying that price should be kept till the last. There were often advertisements of books which did not state the price, and in his own case he knew he had not troubled to send for the pamphlets offered in these advertisements. In many cases the buyer insisted on knowing the price at once.

Mr. Young related an instance of a sales expert who quoted a price for his services and subsequently offered to cut it in half. This did not appeal to him, and had given him rather a bad impression of experts, and it had a bearing on what Mr. Attwood had said about not selling on price. However, he confessed that the lecture had rather modified the view he had formed from that one experience.

Mr. L. L. Robinson (Hackney) said the practical question was how they were going to bring home to directors of electricity supply companies and members of electricity committees what an important matter selling really was. All over the country there were undertakings which for years and years had generated electricity and obliged people by selling it when they came and demanded it. It had only been in recent years that the industry had realised that selling would enormously increase outputs and reduce costs; therefore salesmen must be properly trained and be paid salaries which would attract the very best men.

Mr. Attwood, on the matter of keeping back the price, said his point was to aim at selling on service rather than price, which, of course, had to be told to the customer some time or other. Mr. Warrilow had made a great mistake in doing the usual thing and trying to get at his man by sending in his card, and they must try unusual methods, because the ordinary methods did not bring success. Business cards he regarded as a nuisance, and too many salesmen failed because they insisted upon doing exactly what others had been doing for years.

THE INTERCONNECTION OF A.C. POWER STATIONS.

It will be recalled that the above-named paper was abstracted in our issue of March 3rd this year, since when Messrs. L. Romero and J. B. Palmer have read it on a number of occasions before the members of various Centres of the Institution of Electrical Engineers. On November 6th it was read at the Western Centre of the Institution, and what follows is an abstract of the discussion that took place.

Discussion at Cardiff.

Major E. E. David (Powell Duffryn Colliery) said the paper was particularly interesting to those in South Wales, as the line connecting the Aberaman and Bargoed Collieries was probably the first between two fair-sized stations in this country. The problem was simple enough when the stations to be interlinked were under one authority, but he could imagine the difficulties that would arise when power stations were run by two different people who were not particularly friendly to each other; each would "pinch" the other's power factor. He considered the power factor of a transmission line was dependant on the line characteristics and on the voltage at the two stations, and not on the power factor of the load at the receiving station. The step-by-step booster with an induction boost filling in the gaps between the steps would have a very great future, but it was rather expensive. With regard to interlinking the various systems in the district, Major David said there was not the slightest reason why in addition to selling coal from the collieries they should not transmit power over h.p. lines to London. They could generate as cheaply and as efficiently as any place in the world and, if the people who were responsible for the restrictions on h.p. transmission lines would only remove them, a bulk power supply could be given to London. They were quite prepared to interlink with any of the London stations, and there was no need to be afraid of synchronising power or power factor. From a capital cost point of view, Major David favoured synchronous condensers instead of boosters.

Mr. Idris Jones (Bargoed Colliery) explained that on his system gas engines and turbines were used, and when a disturbance occurred the gas engine-driven generators came off the bars.

Mr. W. Nairn (Bristol Tramways Co., Ltd.) found himself on the side of those who did not think there was very much scope for the interconnection of large modern power stations in this country. He considered the advantages were limited in practice. In the case of a strip or a burn out, interconnection might be of substantial advantage, but he thought that money could be better spent at the station where the shortage of plant was.

Mr. J. W. Fidoe (Cardiff) suggested that when there was a probability of two stations being laid down, would it not be better when the second station was in view to generate at a sufficiently high voltage to obviate the necessity of using transformers on the interconnecting link at all.

Prof. W. Bacon (Swansea University) felt very diffident about discussing the paper after the hon. secretary's remark that discussion on the mathematics of the paper was tabooed. How was it they got such remarkably good annual load factors in America—was electricity there so cheap, or was everybody so rich that they never troubled to switch off?

Mr. F. Tremain (Chairman) inquired about the type of insulator used in America in order to avoid that incrustation which lowered the insulation so much in this country.

Mr. J. B. Palmer (joint author) said that both Major David and Prof. Bacon spoke as if the power systems in this country were too insignficant to be compared with those in America. That was not his (Mr. Palmer's) view at all. If Major David's dream did come true and he had to transmit from Bargoed to London he would find all difficulties would disappear; the thing that impressed him (Mr. Palmer) very much in America was that difficulties simply did not exist. Over there the stations came on just as the voltage requirements called for them, and there was no jealousy between stations—the load controller was a despot. Regarding whether it was advantageous to interconnect, personally, he agreed with Mr. Nairn, and a lot of "tosh" had been talked in this country, but there were other aspects. Spend money on generating plant if it was possible to put loads on to stations where otherwise they would be idle, but if it were possible for a station to import energy, why not let it do so? Power companies were in business to sell electricity, whether they purchased or generated it made no difference. In connection with the load factors on American systems, a large number of factors contributed to those very desirable figures, but they were really outside the scope of an engineer; they were subjects for the political economist. The standard of living was very much higher—the smallest workmen's dwellings were wired throughout with power plugs. In California, irrigation formed a very large portion of the load, and came on as soon as there was plant to spare, and where the incidence of load was controlled, the load factor was bound to be high. Railway electrification in the States was also on a scale which we on this side had not even commenced to think about.

Mr. L. Romero (joint author), in the course of his reply, said that on the Manchester-Salford interconnection lines at light loads the difference in power factor at the two ends of the line was very great, due to the magnetising current of the large transformers, which at light loads became an important proportion of the load transmitted. Power-factor transmission did not depend on the loads connected to the two stations, but purely on the voltage difference and the amount of power transmitted. The effect of a gas engine missing its beat would simply mean that the other prime movers on the line would have to supply the power for that portion of time. Interconnection was conducive to both reliability and economy. He had been rather surprised at the remarks concerning the difficulty with the human element; where the interconnected stations were under one authority, the difficulties could be very easily overcome—where different authorities were concerned, a lot of good-will would have to be exercised.

Messrs. W. A. Chamen, Thomas, Jenkins, Morley-New, and C. T. Allan also contributed to the discussion.

Broadcasting in the U.S.A.—The Government is celebrating the first anniversary of licensed commercial radio broadcasting. There are 542 licensed stations in the United States. The number of receiving sets in use defies estimation.

A year ago there was one licensed broadcasting station in New Jersey—the Westinghouse plant at Newark. To-day there are twelve. The Westinghouse licence was issued in September, 1921, making it one of the first three in the country. Four of New Jersey's twelve stations are in Newark.

Many other states have more. California leads with sixty-six, Ohio has thirty-five, New York thirty, Pennsylvania twenty-nine, Texas twenty-eight, Wisconsin twenty-three, Kansas fifteen, and Michigan eleven. The rush of late comers to get into the field, a rush which was the more remarkable because broadcasting yields no profit except that of good-will, has in many districts all but disrupted, through interference, the service.

Applications for licences first began to pour into the Government radio bureau last spring. At the end of February, 1922, less than sixty broadcasting licences were in effect. Two months later well over 200 stations had been licensed. In May, ninety-seven additional licences were granted and, although this established a monthly record that has not since been excelled, there is still no indication that the end is in sight. In October thirty-nine more prospective broadcasters were licensed.—*T. & T. Age.*

LEGAL.

Claim for Electrical Work.

In the Shoreditch County Court, on November 10th, before Judge Cluer, Messrs. Bainbridge & Halesworth, Hackney Road, N.E., electrical engineers, sued Phil Solomon, Hackney Road, N.E., tailors and outfitters, to recover £8 7s. 6d., for electrical work done. Mr. Fior appeared as counsel for the defence. The defence was that the work was not done to the satisfaction of the Borough Council, and would have to be done again. The plaintiff, Mr. Bainbridge, gave evidence, and said he had to do the electric wiring of the shop. There was no fixed price, because defendant first wanted alterations done, and then decided on complete wiring. The cost came to £11 7s. 6d., and he had received £3. He had a letter from the Bethnal Green Borough Council to say that the work was approved, but admitted that in a later one it was complained that the distribution board was incorrectly connected. Supposing it to be so, it was only a twenty-minutes' job to put it right, but he had not done it as he could not get his money; nevertheless, he had offered to do it.

Judge Cluer said that if there was one little thing wrong it did not prevent the plaintiff's receiving the proportion for the work that was right.

The defendant said that his complaint was that the plaintiff had overcharged for the lights, and that some of the lights had gone wrong and it looked as though they all would go.

Plaintiff said that they had been burning night and day since he fixed them.

A witness said that he saw the work and found it improperly done, but the engineer afterwards gave a certificate to the effect that it was properly done.

Judge Cluer said this showed the value of such certificates. He would allow 7s. 6d. to put the distribution board right, and gave a verdict for the plaintiff for £8, and costs.

Electric Supply Corporation, Ltd., and Reduced.

Mr. Justice P. O. Lawrence, on November 14th, heard a petition by this Corporation for the sanction of the Court to a reduction of its capital by writing off £100,000 as lost or unrepresented by available assets.

Mr. Jenkins, K.C., stated that the company was formed in 1897 to carry on an electrical undertaking and the supply of light and power, and it had a very considerable business. The issued capital was £250,000, divided into shares of £5 each. It was proposed to reduce the capital to £150,000, divided into 150,000 shares of £1 each. Counsel stated that he had affidavits proving the loss.

His Lordship sanctioned the reduction.

British Thomson-Houston Co., Ltd., v. the N.L.O. Co.

In the Chancery Division on November 14th, plaintiffs had a motion for judgment in default of defence against the N.L.O. Co., of Walton, Liverpool, for an injunction restraining the latter from infringing their electric lamp patent.

Mr. Sandeman, for the plaintiff company, said the matter was in order.

Mr. Justice Russell made an order for an injunction as asked for.

Mr. Justice Romer, on the same day, made an order granting an injunction restraining the N.L.O. Co. from infringing the plaintiff company's letters patent for improvements in evacuated vitreous containers.

The matter came before the Court as a motion for judgment, no defence having been put in.

Dryers, Ltd., v. Crypto Electrical Co., Ltd.

In the King's Bench Division, on November 20th, the plaintiffs, a Manchester firm, sought to recover £430, the value of machinery supplied to defendants. The case was heard by Mr. Justice Rowlatt, and it was agreed that defendants should open.

Mr. Langdon, K.C., said that a plant for the impregnation and drying of motor and dynamo insulation was ordered by the defendants under a contract made on January 14th, 1920. The delivery was to have been made in March, 1920, and defendants said that it was provided in the contract that liquidated damages of £5 per week should be paid during the period delivery was overdue. Secondly, it was arranged that the penalty should not become payable at all unless the moulders' strike, which was in progress, was settled within ten days of the date of the contract. At the time negotiations for settlement were still in progress, and in a sense the strike was settled the day before the contract, although defendants were content to take the date as January 22nd, 1920. In the claim the price was increased by 25 per cent., and plaintiffs said that this was permitted by the contract owing to an increase in wages. Defendants contended that an increase of 6 per cent. over a previous quotation covered wage increases between August, 1919, and January 14th, 1920. Counsel then read correspondence between the parties, and Mr. Ashton, K.C., on behalf of the plaintiffs, replied to the points raised.

His Lordship, in giving judgment, said that it was clear that the provision in the contract was for liquidated damages, and not for penalties. These damages were very difficult to estimate. It was contended by the plaintiffs that the strike was only settled when the men resumed work. The settlement arrived at by January 12th was subject to a ballot of the men, and could not be considered definite. His Lordship had not the least doubt that the strike was settled upon January 22nd within the meaning of the contract. With regard to the increases, it was true that the 6 per cent. addition covered awards of increased wages between August, 1919, and the date of the contract. But there was a subsequent increase; this, however, was awarded after the agreed date of completion of the contract, when plaintiffs were in default. A party with whom a contract to do certain work in a certain time was broken as regarded delivery was not bound to treat the contract as cancelled. He thought the buyer was entitled to say: "I will not cancel; I insist upon the whole contract, and the contract is for penalties."

Mr. Langham said that he and his friend had agreed a sum of £52 10s. for a pump belonging to the plant. The defendants had paid £200 into court. Mr. Ashton said that upon his Lordship's judgment the plaintiffs were entitled to £150. Judgment was, therefore, entered for the defendants, with costs, and it was ordered that £150 should be paid out of court to the plaintiffs and £50 to the defendants.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Estimating for Internal Wiring Contracts.

In your issue of the 3rd inst. "Randolph" calls attention to a Government publication entitled "Scottish Mode for the Measurement of Electrical Work, 1918," and states that the mode laid down embodies most of the methods advocated in my article on estimating for internal wiring contracts which appeared in your issue of September 1st.

Unfortunately this statement is incorrect, as Specific Rule No. 2 in the Scottish Mode absolutely violates the fundamental principle laid down in my article.

Specific Rule No. 2 deals with circuit wiring, and is as follows:—

"2. Circuit wiring shall be classified as:—
(*a*) Wiring to lighting points.
(*b*) Wiring to plug points.
(*c*) Wiring to 1-way switch points.
(*d*) Wiring to 2-way switch points.
(*e*) Wiring to intermediate switch points.
And Scheduled for a *rate per point*.

"In scheduling lighting points each outlet shall be rated as one point up to a maximum of three lights in one fitting placed at the outlet. Each additional three lights, or part thereof in the same fitting shall be rated as an additional point.

"In scheduling switch points, each switch shall be rated as one switch point up to a maximum of three lamps controlled by the switch.

"Each additional three lamps, or part thereof, controlled by the same switch, shall be rated as an additional switch point."

In practice how does this apply, and what is the result?

Let us assume that under a contract a certain wiring point is scheduled for a three-light fitting controlled by one switch; the purchaser later decides to have a four-light fitting in lieu of the three-light fitting, but retaining the one-switch control.

The result, under this Scottish mode of measurement, is that the purchaser, apart from paying the legitimate difference in cost of the larger fitting, has to pay for one extra wiring point and one extra switch point. Why, when no extra material or labour has been involved?

Surely a most unbusiness-like and reprehensible method, and against the law of equity.

It is a matter for regret that when an attempt was being made to improve the mode of measurement for electrical work greater advantage was not taken of the existing knowledge and experience of this subject.

Alan Kirk.

London, *November 3rd*, 1922.

The Development of Small Water Powers.

The article by Prof. Gibson, which appeared in last week's Electrical Review, is peculiarly interesting to me because the same subject has been my hobby for the last year. In fact, I am reading a paper on it before the (N.W.) I.E.E. Students at Houldsworth Hall, Manchester, on December 5th. I have even worked out, in more detail, a power scheme similar to that suggested by Prof. Gibson, namely, a number of automatic induction generators linked into one system.

I would like, however, to criticise his general scheme of lay-out (*i.e.*, one controlling station supplying magnetising current for all the generators), because the magnitude of this

lagging current which is consumed by an induction generator, in its combination with the generated leading current, results in a current vector of supply which has a still greater angle of lead. This is, of course, absolutely useless for an industrial load unless the controlling station supplies a large lagging "wattless" current to negative the discrepancy between the power factors of supply and demand.

Under ordinary industrial conditions, the controlling station would require to have a nearly wattless kVA output, roughly equal to the kVA of the load, and the power output would never be negligible on account of the large copper losses involved. It would, therefore, appear that extra steam-raising and turbine plant could be installed and the total load supplied from the same station, with an increase in initial cost far less than that of the entire hydraulic development.

I would suggest that the power-factor of each induction generator be corrected to about unity at its terminals by an electrostatic condenser—the voltage be set, and the supply of magnetising current ensured, by large synchronous motors or rotaries in the load—the frequency be stabilised by water-turbine governors—and a steam station thus be rendered unnecessary, except from the hydraulic point of view, when it would be free to supply only power current.

Ian M. E. Aitken, B.Sc.

Portobello, *November 18th*, 1922.

Steam Condensing Plant.

I should be much obliged if you would give me a little of the valuable space in your paper to reply to a letter which appeared in your issue of November 10th, on steam condensing plant, written by Messrs. H. Fothergill & Co. My reason for this request is that I am thoroughly familiar with the Delas jet, as well as a considerable number of other makes, which are at present being sold in this country and abroad.

The first impression I obtained from Messrs. H. Fothergill and Co.'s letter was that the Delas air extractor, as manufactured by Messrs. Cole, Marchent & Morley, Ltd., has already established for itself such a strong reputation as compared with other steam jet air extractors, that the makers of other types are compelled to endeavour to defend the position, and the rather peculiar tone of the letter would have induced me to anticipate that Messrs. Fothergill & Co. are probably interested in a competitive steam air jet extractor and should have some knowledge of this type of apparatus, but its context seems to prove otherwise.

Messrs. Cole, Marchent, & Morley Ltd., in claiming a steam consumption 20/25 per cent. better than that of other types of steam jet air extractors, have summed up the results of tests made by an eminent and independent engineer in this country, and it is evident that Messrs. H. Fothergill & Co. would like to check these results, but the method they suggest would not give the desired result. It is proposed by them to carry out tests on three plants in commercial use, which include the turbine, condenser and the C. M. & M. Delas air extractor.

My 15 years' experience with condensing plants (although 15 days would have been sufficient) would lead me to anticipate that this method of testing would not give any comparative result.

First, the vacuum in the condenser does not depend only upon the air extractor. It depends more, if anything, on the temperature and amount of water used for the condensation of a given amount of steam. It also depends on the surface of the condenser per pound of steam to be condensed. Again, the design of the condenser is important, the velocity in and cleanliness of the tubes, and last, but not least, the weight of air sent into the condenser by direct leakages in the turbine or pipe lines, and with the steam used in the turbine.

If Messrs. Fothergill & Co. make an opportunity to have the above statement checked, they will, I expect, come in line with me if I suggest that Messrs. Fothergill's method of test could be compared to a test of the resistance of two electric wires by winding them into electric fires and putting them in two different rooms with a different number of open windows in each room, and then measuring the final room temperature to check the ohmmeter indications.

About the second part of the letter dealing with the Delas patents, I believe Messrs. Fothergill & Co., when they say that putting water on an ejector is well known. I remember seeing an old fireman very long ago putting a wet rag on an injector which would not start working.

Without criticising the British Patent No. 157221, I can say positively, with the experience I have had with the Delas ejector, that it is quite one thing to water-jacket the diffuser and quite another to design the diffuser correctly to take advantage of the water-jacketing, and the combination of the diffuser and water-jacket used in the C. M. & M. Delas ejector is protected very well by numerous Delas patents.

May I say, in conclusion, that I have knowledge of a firm which tried to put water around its ejector to improve it, with the unforeseen result that there was a considerable fall in the vacuum, and, in fact, the water-jacketing was a considerable disadvantage to the jet.

To give the great stability of working and the maximum efficiency in steam consumption which is obtained in the Delas jet, the combination of the water-jacket and a convergent-parallel diffuser is essential, and it would be found by firms which experimented on these lines that even more than this was necessary to get the remarkably good results which have been obtained with the Cole, Marchent & Morley product.

R. Velut.

Wembley, *November 17th*, 1922.

Shift Engineers' Salaries.

Your correspondent, "Fed up," talks about the grievances of the 20,000-kW station men; but what about the class A stations? Last year there were over 140 class A and under stations, all of which will in time qualify for class B. This year seven do so, by extensions, and everyone from grade one to grade seven gets an increase of £30 per annum by the E.P.E.A. schedule. But the shift engineers by the same schedule get nothing. It seems to me that all that the shift engineers get is the increase of responsibility due to increased plant, while grades one to seven get the increase of £30, and nearly all of these men got more than twice as much increase as the shift engineers in the first application of the schedule.

Waiting to be Re-classified.

November 17th, 1922.

In connection with the recent correspondence on the above subject, may I suggest that your valuable paper is not the correct medium through which these grievances should be voiced? General meetings of the E.P.E.A., or the correspondence columns of the *Electrical Power Engineer* are the channels through which most good will accrue to those with a grievance.

I am an industrial member of the E.P.E.A., and, as such, have received perhaps less *direct* benefit than any shift engineer breathing; but to "write to the REVIEW about it" would be just about as logical as would my running to a greengrocer's to get my boots repaired. I think that E.P.E.A. members with a grievance might remember:—

1. That the majority of readers of the REVIEW are not directly interested in the rights or wrongs of the shift engineer or any other special class of engineer;

2. That they are doing the Association, and themselves, no good by making public grievances which, however slight actually, will in some quarters be not only misconstrued, but magnified and considered evidence of a lack of unity and strength in the Association.

At any rate, shift engineers have an excellent opportunity of obtaining redress if they use their voting power judiciously at the forthcoming committee elections. I may say, however, that though I attend my Section general meetings regularly, I have not yet heard any dissatisfaction expressed by any of the shift engineers present. I take it, therefore, that the aggrieved ones are either in a minority, or else that they are very backward in coming forward—in which case the Association is not to blame, but only themselves.

Industrial.

November 12th, 1922.

Further to the letter of "Welfare"—it is questionable whether the E.P.E.A. *has* improved the lot of its members permanently. Some of them, yes—the majority, no. The number of generating stations multiplied by four gives us approximately the charge-engineer element in the kingdom. Compare this number with the membership of the E.P.E.A., and you will find it is a big percentage (it is, incidentally, the only apparent reason for keeping him bottom dog). This large percentage claims that its prospects are being ruined by the provision in the schedule which states: "The *highest* paid charge engineer shall be Grade 8." If this is not slamming the door in the face of his prospects as a charge engineer, what is it?—and why on earth should a "Trade Union" put the highest paid in the bottom grade?

The charge engineer, therefore, says the E.P.E.A. has *not* improved his lot."

In a large number of stations, Grade 3 is the next Grade above Grade 8. If some Anti-Waste candidate or Ratepayers' Protection Association asks, "why," who can answer it? If the charge engineer does not get a higher grade, then the Grade 3 man is booked for a fall to, say, Grade 5. Where will *his* permanent advantage be? These two cases directly affect more than half the membership, and indirectly the rest.

As "Welfare" says, there's still a lot to do, and to quote "Fed-up," let's get on or get out.

Four Shifts.

November 13th, 1922.

I am pleased to note that there are at least a few of the shiftmen who can really see how the E.P.E.A. have left the shift engineers little better off than pre-war. The question arises: What are the Grade 8 men doing to bring their anomalies prominently before the N.E.C.? The previous correspondents obviously share my view that the efforts to secure justice are both feeble and deplorable. It is more

surprising, now that there is a new schedule on the way, that there are no amendments for improving the grading of charge engineers. Yet there are no comments from the band of shiftmen who, I have concluded, have not even the pluck to voice their grievances before their own committees. I feel sure that if the N.E.C. saw that the men were in real earnest it would awake to the fact that something must be done.

Midland Counties.

November 12th, 1922.

I should like to support your correspondent "Fed Up" in his suggestion that reductions of charge engineers' salaries should cease.

So far, charge engineers have only had the honour (?) of getting everybody else very fat salaries, while they themselves have got absolutely nothing, but the insult of being degraded to the bottom of the list.

Isn't it time charge engineers got together and did something for themselves?

Ex-Service Man.

November 20th, 1922.

I offer my heartiest support to your correspondents "Fed Up" and "Fair Play."

Let us decidedly get on, or get out.

Shift Wallah.

November 20th, 1922.

Instrument Transformers.

"S.M." in his interesting article on instrument transformers, in your issue of November 10th, has endeavoured perhaps to cover too large a field for a single article, and from some of the data given it would appear that the "switchboard" pattern only has been considered.

For instance, referring to the design of current transformers, a "usual" figure of 600 ampere turns is given for the primary winding, but, in fact, no experienced designer would allow less than 1,000 for a transformer to stand a load of, say, 40 volt-amperes, even supposing the core to be of the jointless or "ring" type, and from 1,200 to 1,500 primary a.t. is often desirable where accuracy over a considerable range of output and frequency is required.

This, of course, somewhat limits the use of the "straight through" transformer, desirable as its simplicity may be, since with 1,000 amps. the loss of accuracy due to low primary a.t. hardly justifies their installation, except for the operation of ammeters, and simple protective devices.

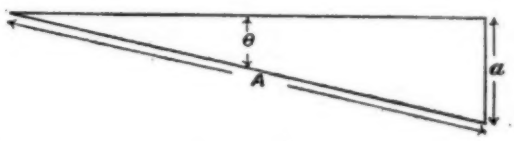
There appears also to be a slip in the v.a. ratings given for various instruments; for example, the volt-amperes consumed by the pressure elements of an indicating wattmeter are given as 20, and for a wattmeter and voltmeter, 14—in fact, 6 less than that of the wattmeter only. Presuming "indicating" to have been written in error for "integrating," the balance left for the voltmeter is still zero.

Transformers having twin secondaries are mentioned, one secondary being used for indicating instruments and protective devices, and the second for integrating instruments. This design, however, would not appear to be very desirable in practice. The reason usually put forward for adopting such a procedure is that the integrating instruments may be adjusted, repaired, &c., without the risk of interfering with the purely protective circuits. Since, however, the total ampere-turns in the secondary must always equal the primary ampere-turns (less a negligible per cent. representing the magnetising a.t.), any current which does not flow in the one secondary must necessarily flow in the other, and with two similar secondary windings the current in each will be inversely proportional to the impedance of their respective circuits. There is thus no fundamental difference between this design and the placing of two 5-ampere instruments in parallel on a 10-ampere secondary—obviously an unstable arrangement. Should the instrument on one side be removed for repair, the current settings of the protective devices on the other will be effectively halved, unless the disused ends are short circuited, in which case the bulk of the secondary current will flow through the short-circuited winding, and but little through that feeding the relay.

This objection may be overcome by the use of a transformer wound with a single primary winding, and having two secondaries, each wound on a separate core. Such transformers are actually obtainable, and by their use the aforementioned difficulties may be avoided, and at the same time the use of entirely separate circuits for the instrument and the protective apparatus is permissible.

The instructions given for measuring the phase angle of current transformers are so meagre as to be almost unintelligible. Apparently the method advocated is to take a reading on a phase-shifting transformer with the secondary wattmeter reading zero, and again with the primary wattmeter at zero. The necessity of the former reading being taken, however, is not pointed out, and in any case with a good transformer the change in reading would be extremely small.

A more accurate method is to set the phase-shifting transformer for zero reading on the primary and note the reading on the secondary with a low reading wattmeter. The latter, divided by the voltage used to excite the instrument, gives the "out of phase" component of the secondary current in amperes, from which the phase angle is easily estimated.



For very small angles the vertical, or "out of phase" component, may be taken as equal to the phase angle expressed in radians, whence (see figure) $\theta = (a/A \times 57.3)°$, where A = sec. 5 amps. and a = out of phase component.

Since, however, the volt elements of the two wattmeters may have themselves slightly different phase angles, extreme accuracy cannot be hoped for with the apparatus as described by the author, and a differential wattmeter is desirable. I hope in the near future to describe a simple yet accurate testing apparatus used by Messrs. Everett, Edgcumbe & Co., and constructed on the differential principle.

Francis E. J. Ockenden.

London, *November 18th*, 1922.

Electrical Trading Relations.

I see from Mr. Warrilow's letter and various reports in the Review, that the Electrical Development Association is trying to increase the demand for domestic electrical gear.

It so happens, however, that in my journeyings up and down the town the only sign I have seen of its activities has been an impressionist poster of a falling chimney—displayed in a barber's shop window in Green Lanes, Hornsey. I hadn't time to stop and read the words, but I presume the picture is symbolical of the E.D.A.'s intention of coming down like a thousand bricks on the discount sharks who are keeping the prices of electrical necessities out of the reach of the majority; keeping up the impression that electricity is a luxury for the rich only. Mr. Warrilow says it is time to cry a halt in the scramble between the manufacturer, superfactor, wholesaler, and retailer, to get at the man who actually uses the stuff. It will be time to cry, anyway, if we don't adopt some means of cutting out some of that "house that Jack built" series of profit-takers.

Recently I spent many happy hours on a stand at an electrical exhibition trying to sell some really good electric irons, well worth 14s., for a guinea. By superb salesmanship I got the old ladies on the stand in dozens ironing their hankies and what-not, and cooing and clucking with delight. Then with brassy stare or painful blush, according as I felt defiant or defenceless, I had to tell them the price, and they all promised to come back and buy one when they had had a look round. They are all still looking round. The beauty of it is that those irons could have been sold at a comfortable profit for 14s., but for the "necessity" of protecting the trade.

More power to the E.D.A. elbow say I; the more chimneys it drops on the trade the better I shall like it.

Weary Salesman.

November 20th, 1922.

Mr. W. E. Warrilow's letter under the above heading, which appeared in your issue of the 17th inst., curiously enough forestalled by a few hours an important point touched upon by Mr. Wallace Attwood in his address at the E.D.A. on the 17th inst., when he emphasised the fact that if progress is to be made in the sale of electrical appliances, there must be a united front of all those parties concerned which form the link between the supply company and the buying public.

Whilst fully endorsing Mr. Warrilow's remarks, I am of the opinion that there are equally important factors to be taken into consideration, some even of more importance than the co-ordination of manufacturers, wholesalers and retailers, if real progress is to be made in the widespread use of electricity amongst the public. They are:—

First, and most important, the necessity of supplying electricity at a figure competitive with gas.

Secondly, the educating of architects on the necessity of designing and equipping all new buildings in such a manner that they can be readily adjusted with every form of electric labour-saving domestic appliances. The rising generation of architects has to be convinced that the day of the open grate and the coal kitchener is passed.

Thirdly, the sale to the public of all electrical appliances of the kind where special technical knowledge is required to overcome the prejudices of old-fashioned methods and to obtain the best results from the use of such appliances should be left mainly in the hands of manufacturers or their agents, until such future time when there will undoubtedly exist a recognised "Official Registration of Contractors," consisting of men who possess a good standard of technical knowledge and practical experience of all matters relating to their profession.

Being myself connected with a firm of contractors, I feel better qualified to ventilate my views under heading three in preference to those under one and two.

Item one is forcibly endorsed by Mr. Hugo Hirst, the chairman of the General Electric Co., Ltd., in his remarks on p. 697 of your Jubilee issue of the 17th inst.

Item two is a subject which, in my opinion, can be best tackled by a joint working committee of representative members of the electrical industry and members of the various architects' associations.

Electric lighting, and all that appertains to it, is that branch of the electrical industry about which the general contractor possesses an intimate knowledge, undoubtedly from the fact that it is the branch which has been longest in existence and most developed.

Therefore, I say, the manufacturer should leave this field wholly in the hands of the contractor, who is well able to tackle all problems connected therewith. By this suggestion I mean that no manufacturer or wholesaler should supply any installation materials of any nature whatsoever, including fittings or lamps, direct to the user, whoever he may be.

On the other hand, I am of the opinion that the time is not yet ripe for all contractors to claim the right to have the whole field for the sale of cooking, water-heating, and other specialised appliances where it is a matter of installing the same on a large scale, with the certainty of obtaining satisfactory results. Surely manufacturers' representatives with their specialised technical knowledge of the appliances they are handling are in a better position to tackle problems of this kind than the average contractor who in the majority of cases has had little practical experience in dealing with these matters.

Enormous damage has been done in the past in attempts to popularise domestic electrical appliances through the ignorance of unqualified salesmen.

I am confident that in time to come, when electricity can be supplied in all great industrial centres at a reasonable rate, the spade work of the manufacturers will reap an enormous harvest for the genuine contractor, and the time will then come when he will be justified in making the same demand to the manufacturers regarding the supply of cooking and other apparatus as he rightly does at the present time in connection with electric light supplies.

It may be that this letter will raise a certain amount of indignation amongst my *confrères*, but in spite of this I feel it incumbent upon me in the interests of the electrical industry as a whole to state my opinion.

H. F. Simon, A.M.I.E.E.

London, *November 21st*, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—W. Bennett, electrical contractor, Back Sitwell Street, Derby.—Trustee, Mr. E. W. Humphreys, Official Receiver, 4, Castle Place, Nottingham; released November 9th.

E. E. Mathers, electrical engineer, 10c, High Street, Doncaster.—Trustee, Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released November 14th.

W. Hurworth & A. A. Watmough (Hurworth, Watmough and Co.), electrical engineers, 41, Town Street, Horsforth, and 1, Back James Street, Harrogate.—Last day for proofs for dividend, December 4th. Trustee: Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds.

G. M. Hallett, electrical engineer, 7, King Street, Frome.—First and final dividend of 1s. 2½d. in the £, payable November 28th, at 18, Nicholas Street, Bristol.

F. J. Maitland (F. J. Maitland & Co.), electrical engineer, Albion Yard, Millgate, Wigan.—First and final dividend of 2s. 2¾d. in the £, payable November 24th, at the Official Receiver's offices, 11, Dale Street, Liverpool.

Busfield & Co. (a firm), electrical engineers, late of 215, Padiham Road, Burnley.—Receiving order made November 9th on creditor's petition.

F. L. Perrin, electrical engineer, 57, Wellingborough Road, and 5, College Street, Northampton.—Receiving order made November 10th on debtor's own petition. First meeting, November 30th, at the Official Receiver's office, Northampton; public examination, December 5th, at the County Hall, Northampton.

W. Ford (Redditch Electrical Accessories Co.), electrician, Central Chambers, Unicorn Hill, Redditch.—First meeting November 23rd, at the Official Receiver's office, Birmingham. Public examination December 11th, at the Court House, Birmingham.

J. R. Gough, electrician, late of the "Aberdeen," Scarborough.—First meeting November 23rd, at the Official Receiver's office, Scarborough. Public examination, December 19th, at the Court House, Scarborough.

H. M. Wollman, electrical factor, of Greasboro Road, Parkgate, Rotherham.—Trustee, Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released November 13th.

Frank Porter, electrical engineer, 17, Goldhawk Road, Shepherd's Bush, London.—This debtor attended on Tuesday before Mr. Registrar Mellor at the London Bankruptcy Court for public examination upon accounts showing liabilities £766, against assets valued at £226. Replying to Mr. Armstrong, Assistant Official Receiver, the debtor stated that in August, 1921, he and another person, who provided the only capital of £40, commenced business at the above address under the style of "Porter & Simpson." The partnership was dissolved in October, 1921, and witness continued the business alone until last July when, being pressed by creditors, he filed his petition. Lack of capital and business experience brought about the failure. The examination was concluded.

Company Liquidations.—The Yorkshire Incandescent Electric Lamp Co., Ltd.—The Receiver (Mr. J. A. Couper, of Leeds) has issued a statement in regard to this matter. He says that every endeavour has been made to reconstruct the company on such a basis as would enable a substantial payment to be made to the creditors. The debenture holders have given every assistance, but the affairs of the company are so much embarrassed that their endeavours have not met with success. As the desired arrangement could not be brought about, the first mortgage debenture holders have appointed him as Receiver on their behalf, and he is now forced to realise the assets. It is apparent that they are not sufficient to realise a sum which will result in a payment of 20s. in the £ to the holders of the second mortgage debentures after the claims of the preferential creditors and the first mortgage debenture holders have been met in full. As the second mortgage debenture holders, for whom he is also acting, cannot possibly receive payment in full, there will be no available funds for the ordinary creditors of the company. The statement of affairs shows as follows: Preferential creditors, £1,371; first mortgage debentures, £5,200; interest to date, £330; second mortgage debentures, £3,000; interest to date, £200; estimated available funds (subject to expenses of realisation), £1,653; estimated deficiency on second mortgage debentures, £1,547; sundry creditors (including London County & Westminster & Parr's Bank, Ltd., which is guaranteed by the directors, £7,975), £16,200; contributories, £2,000; estimated deficiency, £19,746. Cash in hand stands at £6; bills receivable, £123; sundry debtors (as per the books, £2,163), estimated to realise £1,300; expense debtors, £130; stock-in-trade (£2,402), expected to realise £2,300; plant and machinery (£3,304), expected to realise £2,200; Gluhfadenfabrik, Switzerland, deposit, £100; Belle Vue Glass Works (buildings) (£4,687), expected to realise £2,500; plant (£300), expected to realise £125; patents and goodwill, £900; total as per company's books, £14,111, estimated to realise £8,554.

Swift Electrical Co., Ltd., 6, Cork Street, Old Bond Street, W.—The report of Mr. J. Barwick Thompson, Official Receiver and Liquidator of this company, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities of £2,745, assets valued at £1,066, and a deficiency of £2,479 with regard to contributories. The winding-up order was made last April on a creditor's petition. The company was registered as a private company in October, 1919, with a nominal capital of £3,000 in £1 shares, and was formed for the purpose of trading as electrical engineers, and manufacturing and dealing in electrical accessories. The whole of the 800 issued shares were taken by the directors for cash. No established business was acquired, but Mr. John Henry Butler (who, with Messrs. Leonard John Evans and Henry Edward Leigh) promoted the company, states that his co-promoters were experienced in the electrical trade, and were in a position to introduce customers to the company. Towards the end of 1920 the company was in need of financial assistance, and on October 18th, 1921, a debenture for £800 was issued to Mr. Butler to secure an advance of that amount. In January last a Receiver was appointed, who had realised the estate and paid off the debenture bond and interest. The unrealised assets consist of book debts, most of which appear to be bad. The failure of the company is attributed to the fall in demand for electrical accessories, in consequence of which the stock had to be sold at a loss.

Globe Supplies (Electrical), Ltd.—Winding up voluntarily. Liquidator, Mr. E. Russell, 69, Milton Street, E.C.

Modern Electrical Supply Co., Ltd.—A meeting of creditors was called for November 22nd. Particulars of claims should be sent to the liquidator (Mr. R. Stephens), 31, Lombard Street, E.C., by November 25th.

Standard Electric Sign Co., Ltd.—A petition for the winding-up has been presented to the High Court by Mr. H. J. Davis, 9, Winter Avenue, Thorpe Bay, a creditor, and will be heard in London on November 28th.

Saxby & Farmer, Ltd.—Winding up voluntarily. Liquidator, Mr. R. Payne, 82, York Road, Kings Cross, N.1. Meeting of creditors, December 4th. Particulars of claims to the Liquidator by December 30th. All debts and liabilities will be paid in full in due course.

Troughton & Simms, Ltd.—Winding up voluntarily. Liquidator: Mr. R. M. Peat, 11, Ironmonger Lane, E.C. Meeting of creditors, November 29th. Particulars of claims to be sent to the Liquidator by January 7th.

Dissolutions of Partnership.—Clampett & Jones, Manchester.—The notice appearing in our last issue was incorrect in one particular. It should have read that claims were to be sent to Mr. Williams (not that debts would be attended to by him). Mr. Williams is the accountant, but the debts have been attended to by the late partners. Mr. R. H. Clampett is continuing business as usual at 13a, Paton Street, Piccadilly, Manchester, while Mr. E. M. Jones is also carrying on business at Pigeon Street, Manchester.

Bright & Cox, builders and electrical engineers, Elmdale Road, Palmers Green.—Mr. W. R. Bright and Mr. S. D. Cox have dissolved partnership. Mr. Cox will attend to debts.

Trade Announcements.—The business of Webster & Sons, electrical engineers, of Folkestone, has been transferred to Mr. J. Cross, of 20, Cheriton Road, Folkestone.

Mr. T. E. Maggs has retired from the firm of Maggs and Gordon, electricians, of Houghton-Le-Spring, and the business will be continued by Mr. Alexander Gordon.

The London address of Messrs. Arthur Lee & Sons, Ltd. (Sheffield) has been transferred to 40-43, Norfolk Street, Strand, W.C.2. Telegrams: "Trubrite, Estrand, London." Telephone: Central 6943.

The Electrical Supplies (Liverpool), Ltd., of Liverpool, have appointed Mr. G. E. Goulborn, 40, Fairfield Avenue, Victoria Park, Canton, Cardiff, as their agent and representative for South Wales District. Mr. G. R. Croskell, 22, Eccleston Street, Wigan, has been appointed representative for Manchester, Wigan, and Bolton, &c.

Mr. A. Whittaker wants electrical catalogues at 3, Manor Road, Folkestone, where he is commencing business.

Catalogues and Lists.—The Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3.—An illustrated mailing card showing a selection of electrical appliances, including fires, small cookers, irons, kettles, &c.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. X2858, giving reduced catalogue prices of automatic circuit breakers.

Westinghouse Electric & Manufacturing Co., East Pittsburgh (Pa.), U.S.A.—Three illustrated pamphlets describing respectively electrical equipment for mine pumps (motors and controllers) safety switchboards with closed fronts, and automatic voltage regulators for a.c. generators.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—A fully-illustrated catalogue (120 pp.) of telephones and telephone accessories of every description. A number of views of actual installations appear, and an index to the catalogue is appended.

The Enterprise Manufacturing Co., Ltd., Electric House, Grape Street, Shaftesbury Avenue, W.C.2.—A net trade price-list of cables, conduits, switches, cut-outs, lampholders, fans, and other electrical accessories and appliances.

The Imperial Engineering Co., 56, Darlington Street, Wolverhampton.—An illustrated price list of boiling rings, fires, water-heaters, and toasters.

The Hotpoint Electric Appliance Co., Ltd., 21, Berners Street, Oxford Street, W.1.—An illustrated and priced pamphlet setting out special terms for salesmen and others in purchasing "Falco" 5280 cookers.

Quickways, 30, City Road, E.C.1.—A pamphlet advertising "Argentum," a silver-plating preparation.

Messrs. Shenton & Co., Ltd., 68 and 69, Shoe Lane, E.C.4.—A fully-illustrated and priced catalogue of "Supreme" electrical novelties, including pocket and torch lamps, lighting fittings, miniature motors and dynamos, steam engines, &c.

Messrs. A. Verey & Co., Ltd., 27, Buckingham Gate, Victoria Street, S.W.1.—List No. 110, a comprehensive priced catalogue of electrical materials and accessories.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—List of reduced prices of switch and fuse gear, and two pamphlets dealing with domestic appliances.

Electrical Conduits, Ltd., Anchor Works, Birch Street, Walsall.—A net price list of conduit and conduit fittings, tumbler switches, lampholders, lighting fittings, &c.

The Skefco Ball Bearing Co., Ltd., Luton, Beds.—An abridged catalogue of bearings of all types. Fully priced.

Ironclad Switchgear Co., Ltd., 23, Queen Anne's Gate, S.W.1.—A mailing card advertising the firm's switchgear.

For Sale.—Messrs. H. Butcher & Co. have been instructed by Messrs. Edwardes Bros., of 20, Blackfriars Road, owing to re-arrangement of partnership, to sell by auction, on December 7th and 8th, at 21, Upper Ground Street, S.E., the stock-in-trade of new electrical accessories, cable, switchgear, &c.

By direction of the Disposal Board, Messrs. Bruton, Knowles and Co. will sell by auction at H.M. Filling Factory, Hereford, on December 5th and 6th, engineers' plant, railway rolling stock and material, &c., and on December 14th and 15th, electrical plant, new electrical stores, fittings, &c. (See our advertisement pages to-day.)

The Warrington Exhibition.—Mr. Harry Rogers, of Friargate, Warrington, has sent us a photograph of the stand held by him in the recent electrical exhibition at Warrington. The display was of a comprehensive nature, including all kinds of electrical heating, cooking, lighting, and labour-saving appliances.

Electric Welders for the United States.—Some surprise has been created in Norway by the publication of advertisements by an American firm inviting applications from electric welders who would be willing to proceed to the United States. One correspondent of the Norwegian newspaper states that it is regrettable for an attempt to be made to deprive Norwegian industry of some of its trained men, while another, representing a native welding company, states that instead of there being a scarcity of welders in the United States, there should be a superabundance of them at present.

The A.E.G.—At the recent annual meeting of the A.E.G., in Berlin, an attempt was made by various shareholders to obtain an increase in the rate of dividend to 40 per cent. at the expense of the works' maintenance fund. In refusing to entertain the suggestion, it was pointed out, on behalf of the board, that there were constant requirements in the direction of the replacement of plant and machinery in the electrical manufacturing industry, and that therefore the amount set aside for depreciation ought to be kept on the pre-war gold basis level. But that was impossible, and it could be understood that many works had anxieties in consequence of gradually consuming their substance, which would later on lead to difficulties in the replacement of machinery and buildings. In the case of the A.E.G., however, the situation was somewhat different; the company's profits were derived from so many sources that it would probably always be able at once to write off its capital expenditure on new machinery and plant. Nevertheless, the sum of 400 million marks proposed to be placed to the works' maintenance fund was the smallest amount with which the directors could be satisfied. After the approval of the accounts and rate of dividend, sanction was given to the issue of new ordinary shares for 300 million marks. A noteworthy event was the election to the board of representatives of the Phœnix Steel Co. and the steel merchant firm of Otto Wolff, of Cologne.

According to a Berlin "Exchange" telegraph dispatch, the great Electro-Metal Trust, founded in October by Otto Wolff, of Cologne, has effected a partial fusion with the A.E.G. It is stated that the new trust rivals in magnitude Stinnes's electro-metal concern, but is less closely united.

Insurance by Industry.—Mr. Bonar Law's statement that he hoped to see further progress in the maintenance of unemployed by the various industries has aroused considerable interest in business circles, says *The Times*. Inquiries among prominent manufacturers showed that there was general agreement with the principle, but the large number of unemployed in certain industries would make it impossible for these to carry the burden without State assistance. It is recognised that insurance by industry would have a steadying influence on the workers, who would be relieved of the fear of unemployment. The Federation of British Industries proposes to issue a report on the subject shortly.

New Business Premises.—The Enterprise Manufacturing Co., Ltd., recently moved from its premises in Bishopsgate to much larger and more central quarters at Grape Street, Shaftesbury Avenue, W.C.2. The new "location" consists of five floors, each of which is devoted to a particular branch of the firm's business. The principal occupation of the firm is the production of exhaust fans. The company also acts as agent for the Vincent Switchgear Manufacturing Co., Ltd., the Stearn Electric Lamp Co., Ltd., Messrs. Barton & Son. (conduit and fittings), and Messrs. S. Hodgson & Co. (motors and dynamos), and examples of the products of these firms are exhibited in the showrooms. The store rooms are fully stocked with electrical material, accessories and appliances, and included in these is a consignment of fans for the 1923 season.

Messrs. Falconar, Cross & Co. have recently completed extensive alterations at their premises, 7 & 9, Ridley Place, Newcastle-on-Tyne, where they carry on business as electrical contractors, specialising in the equipment of ships, factories, town and country houses, and other buildings, as well as repair work and electrical supplies of all kinds. A few months ago a new department of the business was organised to deal solely with the supply and repair of electrical equipment for motor cars. Ample facilities are provided for the repair, replating and recharging of all types of batteries, and for the fitting, repair and adjustment of dynamos, starters, and other electrical accessories used on cars. A handsome new front has been erected, with a window about 40 ft. long, for the display of goods; the showroom on the ground floor is fitted with a selection of fittings, domestic appliances, &c., all connected up for demonstration, and adjoining this are the general and works offices, which overlook the store and garage; other offices and stores are located on the upper floors. Separate entrances from Vine Lane at the rear give access to the stores and workshops, and also to a garage which will house four or five cars on which electrical equipment is being repaired or installed.

Electrical Christmas Gifts.—A recent issue of the Toronto *Electrical News* shows that the Canadian electrical appliance manufacturers and dealers are fully alive to the possibilities of increased sales during the Christmas season. Several pages are devoted to the subject, and a wide range of possible electrical presents is illustrated. A list of more than 150 appliances and accessories is given, and these are classified under the following heads:—"General Servants in the Home"; "Mostly for the Young People"; "Radio Accessories"; "Electric Conveniences and Luxuries," "Invalid and Sick-room Comforts"; and "Electric Automobile Fittings." The most striking feature of electrical gifts is that, like any other gift, they are obtainable at prices to suit everybody.

Book Notices.—"The King's Engineer," No. 1, April, 1922 (28 pp.). London: King's College Engineering Society. Price 2s. 6d.—This is the first number of a journal which is to be published annually by the King's College Engineering Society and the Engineering Branch of the King's College Old Students' Association. It is interesting to note that the Engineering Society was founded in 1847, the 75th anniversary address (which is reproduced in the journal) having been delivered in February last. Articles contained in this issue include "'Administration' as a Qualification for Engineers," by Brig.-Gen. M. Mowat; "Improving Two-Stroke Internal Combustion Engines," by Mr. R. C. Wallace; "Prospects in Branches of the Profession," by Mr. C. H. Wordingham, C.B.E.; and "The Sladen Valley Waterworks," by Mr. H. F. Colman (abstract). In addition, there are numerous notes dealing with social functions, other institutions, and matters of interest to old students.

"Motor Headlights" (39 pp.). Cambridge: The University Press. Price 2s. 6d. net.—This is a series of fourteen papers, reprinted from the *Transactions* of the Optical Society, dealing with improved designs of motor headlights to minimise dazzle, and describing devices which may be applied to existing types of lamps.

"La Force Motrice Electrique dans l'Industrie," by E. Marec; pp. viii+613, 541 figs.; price 55 fr. "La Radio Telephonie," by C. Toché; pp. 4+98, 44 figs.; price 10 fr. Paris: Gauthier-Villars et Cie.

"Lubrication and Lubricants," by J. H. Hyde; pp. x+114, 37 figs.; price 2s. 6d. net. "Incandescent Lighting," by S. I. Levy; pp. x+129, figs. 22; price 3s. net. London: Sir Isaac Pitman & Sons, Ltd.

"Electrical Transients," by C. E. Magnusson, A. Kalin, and J. R. Tolmie. Pp. viii+193; figs. 161. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

"Where to Buy Everything Electrical" (104 pp.). London: S. Davis & Co. Price 2s. 6d. post free. October, 1922, edition.

Messrs. Constable & Co., Ltd., have sent us their November list of new and forthcoming books, including several of a technical nature.

"M. & C. Machine Mining," November. Glasgow: Mavor and Coulson, Ltd.—One article in this issue describes the linking-up of two collieries by machine mining. There is also a letter from a German engineer regarding machine mining in his country, and a description of the firm's 3-phase chain coal-cutter.

Small Lighting Plant Contracts.—Messrs. Truslove and Co., Colchester, have recently received an order for a 4-5-kW "Truslove" lighting set and a complete lighting installation for Aylsham Union, Norfolk. Another set, together with a lighting installation, is being put into the Earl of Warwick's residence at Beer, South Devon.

Unemployment.—The number of persons on November 13th recorded on the live registers of the Employment Exchanges in Great Britain as wholly unemployed was 1,377,100. This was 10,326 more than in the preceding week, and 446,633 fewer than the figure recorded at the beginning of last January.

The number working short-time and drawing benefit for intervals of unemployment was 50,200 on November 13th, as compared with 49,631 on November 6th, and 934,786 on July 1st, 1921.—*The Times.*

E.D.A. Activities.—The Electrical Development Association has published a number of new and reprinted pamphlets dealing with many phases of the use of electricity. All of these are written in clear vigorous language, presenting the case for electricity in a very telling manner, and the illustrations are equally attractive. The E.D.A. is not content to say that electricity is "the thing," but gives reasons—economic and hygienic—why electricity should be used in all departments of life.

The British Industries Fair.—The preliminary arrangements for the booking of space and stands at the British Industries Fair (Birmingham) for the 1923 Fair, to be held from February 19th to March 2nd, are rapidly nearing completion. British manufacturers have flocked very readily to assist by their active support in making the 1923 Fair bigger and better than any of its predecessors, and it is anticipated that a very much larger number of Home, Colonial and foreign buyers will be in attendance at Castle Bromwich during the period of the Fair than on any previous occasion. The structural alterations that will make the permanent buildings of the Castle Bromwich Aerodrome the largest exhibition hall in the country are proceeding, and will be quite completed by next February. The Council of the Fair is prepared to consider a few more applications for space. These should be sent to the General Manager, British Industries Fair, Chamber of Commerce, Birmingham, who can deal with any other inquiries regarding the Birmingham Fair.

Chinese Note.—The Tung Lee Electric Light Co., Ltd., in Chekiang, has applied for licences of trade to the Ministry of Communications, and the request has been granted.

Social.—On November 17th the annual dance of the Paisley Electricity Department was held at the Town Hall. There was a large company and the hall was illuminated by means of flood lights.

The Electrification of Russia.—The Scientific Technical Department of the Russian Council of Economy in Berlin is reported to be publishing in Russian a technical economic journal at No. 11, Lietzenburger Strasse, Berlin, 15. The journal is said to deal with many important problems, including the electrification of Russia. A recent issue contained articles by Professors Chatalin and Worobjiw on the electrification of Russian agricultural districts, the oil-field district of the Caucasus, and the suggested establishment of a bank for the promotion of electrical schemes.

Lead.—In their report, dated November 18th, Messrs. James Forster & Co. state:—"There has been little of interest to report. Business on the speculative side has been on a very small scale. Consumers have bought but little, and for export there is little demand. On the other hand, there is a considerable falling off in imports so far this month, as was to be expected after the very large arrivals in October. With anything like the average of arrivals of the last four months, however, there should be little chance of increase in values, but manipulation and speculation largely govern the market. Consumption in the electrical cable and allied trades continues good, but there is nothing very encouraging in the home trade for sheets and pipes."

Copper and Lead Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespeare report November 22nd:—No change in copper and lead quotations.

LIGHTING AND POWER NOTES.

Ambleside.—Opposition to Price Increase.—The Urban Council is opposing the application of the Windermere and District Electricity Supply Co. for a revision of its authorised prices for electricity.

Australia.—Sydney (N.S.W.).—According to the *Sydney Morning Herald*, the accountants to the City Council have submitted a report, in which they recommend that a separate department should be formed to deal with the actual sale of energy. Mr. Forbes Mackay, the city electrical engineer, is opposed to this arrangement, and has hinted that he would resign if it were brought into being.

There is much discussion with regard to a proposal to take a bulk supply from the Railway Commissioners as an alternative to erecting a new station, the first stage of which would cost about £1,000,000. Mr. Mackay has been asked to prepare an estimate of the cost of a new station, and at the same time the Commissioners have been requested to state their terms for a bulk supply.

Bexley Heath.—Proposed Bulk Supply.—The Urban Council has decided to continue negotiations with a view to obtaining a bulk supply of electricity from Woolwich or elsewhere.

Billingham.—Application for Order.—The Cleveland and Durham County Electric Power Co. has applied for an Order to enable it to supply electricity to the district.

Blackpool.—Year's Working.—There was a net profit of £14,322 on the electricity undertaking during the past year, compared with a net profit of £8,180 in the previous year.

Chadderton.—Electricity Order.—The Electricity Commissioners have received an application for an Electricity Order which will enable the Urban District Council to purchase electricity in bulk and distribute it in the area.

Continental.—Italy.—A concession has been granted to the Società Forze Idrauliche Alto Brembo to utilise the waters of the upper part of the Brembo River to work five hydro-electric stations of a total capacity of 35,668 h.p.

Russia.—On October 10th, the newly-equipped electric power station at Krivoi Rog was put in operation. The work of equipment occupied six months.

Chorley.—Contemplated Electricity Supply.—The Town Council is to consider within the next few months the question of the supply of electrical power to the district.

Chosen.—Seoul.—According to H.M. Consul-General at Seoul, the Kongosan (Diamond Mountains) Electric Railway Co. has obtained official permission to supply electricity to Seoul, and it is hoped to commence the supply from September of next year. The generating station of the company, in which a plant of 3,200 kW is to be installed, is nearing completion. This is situated at Chudairi, Kogen Province, a distance of 62 miles from Tetsugen (Corean, Cholwon), a station on the Seoul-Gensan railway, which is to be the terminus of the line; from Tetsugen to Seoul the distance is about 61 miles, so that the current will have to be transmitted a distance of over 120 miles in all. The total cost of the transmission line is estimated at nearly 4,000,000 yen. Construction work on the railway line itself is proceeding, and it is hoped to open the first section between Tetsugen and Kinka (Corean, Kimwha), a distance of 18 miles, during the course of next year.—*Eastern Engineering.*

Darlington.—Year's Working.—There was a net profit of £4,295 on the electricity undertaking for the past year.

Doncaster.—New Plant.—On November 16th the extensions of the generating plant were formally inaugurated. The new plant, which has cost approximately £100,000, consists of two 3,000-kW turbo-generators and auxiliaries, and it is noteworthy that the space they occupy was formerly taken up by plant having a capacity of only 450 kW.

Lighting New Houses.—The Town Council has rejected a recommendation by the Housing Committee that three electric lamps should be supplied free of charge to each Corporation House on the Carr House site.

Dublin.—Proposed Co-operation.—A recent public meeting in Kingstown discussed the proposed amalgamation of the South Dublin townships as one corporate body with a joint electric lighting scheme. Mr. F. J. Mallins, who presided, said that Dublin Corporation was moving to annex the townships, but they would be better off with a scheme of their own, and the only possibility of the commercial success of an electric lighting scheme lay in having one power station for all. Intimation was received from the Kingstown Council that it was making new proposals for a supply of electricity in bulk, while the consulting engineers were at work on a revised scheme for the townships.

East Grinstead.—Loan Sanctioned.—The Urban Council has received sanction to a loan of £18,000 for the new electricity scheme.

Eton.—Protest Against Price Increase.—The Urban Council has decided to oppose the application of the Windsor Electrical Installation Co. for an Order to make permanent the maximum charge of 1s. per unit for electricity, with minimum payments of 15s. for each winter quarter and 10s. for each summer quarter. Steps are also to be taken in conjunction with other public bodies concerned to endeavour to get better terms for consumers.

Electricity Districts.—Local Inquiry.—In pursuance of the provisional determination of the East of Scotland Electricity District, the Electricity Commissioners will hold a local inquiry in the City Chambers, Edinburgh, on December 12th, 1922, at 10.30 a.m., and following days, with reference to the area to be included in the proposed district and to consider a scheme which has been submitted by the Corporation of Edinburgh for the formation of a Joint Electricity Authority for the area. Copies of the scheme may be obtained from the town clerk, City Chambers, Edinburgh (1s. 6d. each), also copies of supplementary particulars (10s. each). Any representations with regard to the scheme should be addressed to the Secretary, Electricity Commission, and to the Town Clerk, Edinburgh, not later than December 5th, 1922.

Procedure at Local Inquiries.—A memorandum as to local inquiries into electricity districts and schemes for the reorganisation of the supply of electricity therein under Section 5 of the Electricity (Supply) Act, 1919, has been issued by the Commissioners, who point out that they do not at present propose to lay down any rules of procedure, but they desire that unnecessary expense should be avoided, and that the inquiries should not be unnecessarily prolonged. In the first place, it is hoped that in the interval between the lodgment of a scheme and its consideration at a local inquiry it may be found practicable for promoters and objectors to confer with a view to adjusting differences or reducing them to a minimum, so as to shorten proceedings at the inquiry. The Commissioners suggest that parties need not be separately represented by counsel or otherwise, unless their interests are divergent, and then only to the extent of such divergence. With regard to witnesses, the Commissioners are of opinion that it should not ordinarily be necessary for more than one witness—representative of each class or group of promoting or opposing local authorities or companies—to be called as to policy. On the technical side of the scheme, promoters and opponents should bear in mind that, while the expert evidence should be adequate to support or criticise the scheme in its different aspects, the mere duplication of such evidence with the object of adding weight is unnecessary. The Commissioners propose that, where possible, there shall be only one local inquiry into both the area and the scheme for the district, and that this shall be the principal inquiry. When a scheme has been approved by the Commissioners as the result of such an inquiry, the proceedings at the further local inquiry required by Section 5 (4) of the Act should ordinarily be more or less formal or confined to specific points of controversy.

Enniscorthy.—Electricity Scheme.—The proposed electric lighting scheme for Enniscorthy was further considered by the Urban Council, when it was mentioned by the chairman (Mr. T. McCarthy) that the draft scheme prepared by Mr. McEntee, of Dublin, would cost £15,000, which, in his opinion, was too high, and would involve a serious loss. He suggested that Mr. McEntee be asked to prepare another scheme, to cost not more than £8,000 or £10,000. Mr. Maher said the Wicklow scheme, for a town of about the same size as Enniscorthy, cost only £6,200. As regarded the Wicklow lighting area, Mr. Tobin said it was twice as large as theirs. It was ultimately decided to adjourn the matter for two months.

Fleetwood.—Peak-load Power.—At a meeting of the Council on November 16th the electrical engineer was empowered to interview power users with a view to obtaining a reduction of their consumption during the times of peak load. The question of the terms and conditions for the future supply of electricity to the Blackpool Corporation for tramway purposes was referred to a sub-committee.

Harpenden.—Electricity Supply Agreements.—The Urban Council has sealed an agreement with the North Metropolitan Electric Power Supply Co., authorising the latter to distribute electrical energy within the urban district. It is hoped that a supply of electricity will be available for business premises by the end of the year.

Holmfirth.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £5,000 on account of £7,350 required in connection with the electricity undertaking.

India.—Hydro-Electric Project.—With the approval of the Government of India, the Government of Madras has sanctioned the grant, subject to certain conditions, to Messrs. Alfred Dickinson and R. D. Richards, on behalf of a syndicate formed of the above-mentioned gentlemen and Messrs. Balfour, Beatty & Co., Ltd., London, and the General Electric Co., Ltd., London, of a concession to utilise the water in the Pykara and Avarai Halla Rivers in the Nilgiris district for the generation of electrical energy for industrial purposes.—*Reuter's Trade Service* (Bombay).

Irish Free State.—Electric Lighting Orders.—Writing to the Kells Urban Council regarding a proposed electric lighting scheme for that town, the Free State Ministry of Industry and Commerce stated that it was obliged for the present to adopt the regulations in connection with Special Orders which governed the issue of Orders by the Electricity Commissioners in London. In the case of Kells, an inquiry was held some time ago, and the list of guarantees and other data had been received. The further procedure would be a little complicated, but, in the first instance, the Council would require to pass a resolution applying to the Ministry for a Special Order to enable the Council to generate and supply electricity.

London.—Battersea.—An explosion occurred on November 18th in a cable inspection box at the corner of Totteridge Road, causing interference with the supply of electric current for an hour. The heavy manhole cover was blown up, and portions of it smashed a number of windows and injured a woman and several children. Six persons were treated in hospitals for injuries arising out of the explosion.—*Morning Post.*

Lye.—Company's Obligations.—The Urban Council is communicating with the Midland Electric Corporation, reminding it of its obligation to lay mains in certain streets, and asking it to quote terms for lighting the main streets from Stambermill to the Hayes, the lamps to be affixed to the tramway standards.

Malvern.—Loan.—The Urban Council has applied for a loan of £3,500 for mains, sub-station, transformers, &c. The Council has received conditional consent from the Shropshire, Worcestershire, and Staffordshire Electrical Power Co. to supply electricity in the parish of Guarlford, which is in the company's area of supply.

Mold (Flint).—Electricity Order.—Application has been made to the Electricity Commissioners for an Order to authorise the Urban District Council to generate and distribute electricity within its administrative area.

Oxford.—Price Reductions.—The Oxford Electric Co., Ltd., has adopted the following reduced scale of charges for electricity:—Lighting, minimum charges of 12s. 6d. for each winter quarter for 15 kWh, and 8s. 4d. for each summer quarter for 10 kWh, next 250 kWh, 10d. per kWh; next 3,500, 6d.; next 2,000, 5d.; beyond, 3½d. Heating, 2½d. Motive power, first 2,000 kWh per quarter, 3½d.; beyond, 2½d. per kWh.

Weymouth.—Year's Working.—The report upon the working of the Weymouth and Melcombe Regis undertaking (engineer: Mr. G. Nicholson) for the year ended March 31st last records a total revenue of £29,467, as compared with £28,359 in the preceding year. Working expenses amounted to £22,810, as against £21,673, leaving a gross profit of £6,657 (£6,687)). Capital charges absorbed £4,708, making the final result a profit of £1,949, slightly more than that of the previous year—£1,911. The capital expenditure during the year was £597, wholly taken up by mains and services. There was a slight decrease in the amount of energy sold, *viz.*, from 1,202,591 to 1,173,056 kWh.

Yeovil.—Electricity Supply Scheme.—Messrs. Petters, Ltd., who obtained a Provisional Order for electric lighting, have informed the Town Council that all preliminary arrangements have been made for the formation of a company to carry out the scheme.

United States.—New York.—The largest turbine-generator ever constructed in a single unit is now being built by the Westinghouse Electric & Manufacturing Co. for the new Hudson Avenue station of the Brooklyn Edison Co. The set will have a rating of 62,500 kVA, three-phase, 60 cycles, 13,800 V, at 80 per cent. power factor. The operating conditions

for the turbine will be 265 lb. steam pressure, 200 deg. Fahrenheit superheat, and 29 in. of vacuum. Two 70,000 sq. ft. surface condensers, probably the largest in existence, are also being constructed by the Westinghouse Co. for this new station. Each condenser will be served by two half-capacity circulating pumps driven by two-speed induction motors. The air-removal equipment will consist of Le Blanc air pumps and air ejectors. The ultimate capacity of the plant will be eight turbine-generator units. Distribution will be at 27,600 V, instead of at 13,800 V as in the other New York power plants, because of the difficulty of getting out sufficient circuits with the limited street space. The switch-house of the plant will use a vertical segregated phase arrangement of oil circuit breakers instead of the horizontal arrangement as at Hellgate and Calumet. Auxiliaries will be largely electrically driven, and a house generator will be used for supplying the essentials of auxiliary load. To ensure continuity of service a careful study is being made of the various systems of supplying power to auxiliary 'buses.—*Electrical News* (Toronto).

TRAMWAY AND RAILWAY NOTES.

Australia.—Victoria.—In connection with the work of converting the Melbourne suburban railway system from steam to electric traction, the Railway Commissioners anticipate that by the end of February all of the lines approved by Parliament in 1912 will be electrified, with the exception of the sections between Box Hill and Ringwood, and between Heidelberg and Eltham. The completed scheme will include the erection of the power-house at Newport with an installed capacity of 105,000 h.p.; the laying underground of 78 route miles of 20,000-V transmission cables, the erection of 51 route miles of overhead 20,000-V transmission lines, and the equipment of 346 miles of single track with 1,500-V d.c. conductors. In addition, 16 sub-stations, having a total installed converting capacity of 116,000 h.p., are being, or have been erected, and 710 motors and trailers fitted with electrical equipment. The electrified system, when completed, will comprise a total of 125 route miles of double track and 20 miles of single track.—*Reuter's Trade Service* (Melbourne).

Although the State Railways incurred a deficit of £19,100 during the 1921-22 period, this was the smallest loss for eight years. In 1914-15 the deficit was £842,436. The improvement is attributed mainly to the increased traffic brought about by electrification and the economies in working which resulted from the same cause. In the Railway Commissioners' report, abstracted in the *Industrial Australian and Mining Standard*, the following statement is made:—"The economic efficiency of electric train operation compared with steam locomotive working had enabled an average increase of about 35 per cent., as compared with the previous steam timetables, to be made in the total number of trains scheduled, the cost of which under steam traction would have been prohibitive, and the fast and frequent electric train service now provided during the slack hours had encouraged considerable additional traffic. On 95 route miles of electrified line, out of a total of 145 route miles, the extra traffic due to electrification (after allowing for the normal expansion that would probably have occurred had steam traction continued, and other factors) was valued at approximately £170,000 per annum, while the increase in the number of passenger journeys was estimated at 12½ per cent. Present indications were that the annual interest on the scheme will be offset by the increased traffic induced through the improved train service afforded by electrification. It was estimated that to run the present electric train mileage under steam conditions would require approximately double the quantity of coal now consumed at the power house to generate current for train operation. In addition, the coal for locomotives would require to be of a higher quality and would be relatively more expensive, while the advantage of the higher speed and the greater flexibility of the electric train would not be available under steam traction."

South Australia.—The report of the Adelaide Tramways Trust (municipal) for the six months ended July 31st, 1922, shows that the revenue amounted to £291,806, and operating expenses to £202,173—a gross surplus of £89,635. After the payment of interest, allocations to reserve, &c., there was a net surplus of £10,938, making a total of £27,179 for the complete year.

Blackpool.—Year's Working.—The net profit on the tramways for the past year amounted to £6,132, against £144 in the previous year.

Darlington.—Year's Working.—There was a net loss of £2,016 on the working of the light railways during the past year.

Eston.—Railless Traction.—The Tees-side Railless Traction Board has applied for a Provisional Order authorising it to extend its system to Eston, and to empower the Middlesbrough Corporation and the Eston Urban District Council to borrow money for the purpose of the undertaking.

Glasgow.—Electrification of Subway.—The Town Council has decided in favour of the work of the electrification of Glasgow subway being let by contract as against by direct labour.

London.—"Underground" Extensions.—In addition to the large amount of work already arranged, the London "Underground" companies have drawn up further schemes of development estimated to involve an expenditure of £6,000,000. The main extension will be the continuation of the City and South London Railway from Clapham Common to Sutton, *via* Balham, Tooting, Merton Grove, and North and South Morden. This will give a continuous line from Edgware in the north to Sutton in the south. The Hampstead tube is to be extended to Waterloo and Kennington, by tunnelling under the river, and the line is to form a junction with the City and South London Railway at Kennington. The stations at Leicester Square and Piccadilly Circus are to be enlarged and improved, and additional facilities are to be provided at Waterloo. It is proposed to commence these works immediately Parliamentary sanction has been obtained.

Sunderland.—Wages Agreement.—The employés of the Municipal Tramways Department have agreed to accept reductions of 2s. in December and a further 2s. at the beginning of January. It is proposed to effect a complete revision in March next.

TELEGRAPH AND TELEPHONE NOTES.

Bulgaria.—Manufacture of Equipment.—By a Bill which has recently passed its first reading in the Bulgarian Parliament, the Government proposes to establish two companies to produce telephonic and telegraphic equipment for the State services. The capital of each is to be 5,000,000 leva, half of which will be held by the State. The object is to free the services from dependence upon foreign countries and to provide employment.

Opponents of the Bill state that the Government should have laid the matter open for international competition; and also that, in any event, the companies will produce sufficient material in three years to equip the whole of the projected services, and this work could easily have been provided for by the enlargement of existing State workshops.

China.—New Radio Stations.—Mr. Schwerin, president of the American Federal Telegraph Co., with four engineers, arrived at Shanghai on November 14th to begin the construction of a high-power radio station capable of transmitting messages round the world. His contract with the Chinese Government provides for subordinate stations at Kharbin, Pekin, and Canton. The Chinese Government is issuing bonds to cover half the cost, and will obtain possession of the stations in twenty years. The machinery is being made at Palo Alto, in California, and the construction of the buildings at Shanghai will be undertaken forthwith.—*The Times.*

France.—International Communication Conference.—The American Government is preparing for the general meeting of the International Conference on Electrical Communication, which it is expected will take place in Paris in the spring of 1923. At this general conference questions formulated and discussed at the preliminary conference held at Washington in October and November, 1920, will be taken up. Consideration of those questions at the Paris conference will be continued until an agreement has been reached by the representatives of all the Governments concerned. The American Government's preparations for the coming Paris conference are being made by an inter-departmental committee formed in Washington, consisting of representatives of the various Government departments which are directly interested in the questions to be discussed, and suggestions have been asked for by the Government from commercial interests and others whose experience in the use of the international telegraph service has brought to their attention certain phases of the question in which improvement should be made, or in which the service could be extended.—*Reuter* (Washington).

Radio Telephony.—Broadcasting.—The British Broadcasting Committee commenced a limited service at 6 and 9 p.m. on November 14th from Marconi House, the broadcasting station for the London area, call sign 2LO, wave length 360 metres, and the transmitter used was of 1½ kW. Transmission also commenced on November 15th from the Birmingham station that has been established at the Witton works of the General Electric Co., Ltd., by the Western Electric Co., Ltd. The power used is 400 watts and the wave length 420 metres. According to *The Times* Sir William Noble, chairman of the Broadcasting Co., intends that each evening there will be given a brief synopsis of the world's news, prepared by the four Press agencies acting together to supply the company with such a synopsis twice nightly. Then the Meteorological Department of the Air Ministry is supplying two weather reports. The first will be given directly the station opens, and the other between 9 p.m. and 10 p.m. In addition to this news there will be concerts, instrumental and vocal.

For the Manchester area the broadcasting station is at the Metropolitan-Vickers Electrical Co.'s Trafford Park Works, call sign 2ZY.

In addition to the above stations, on Tuesdays Writtle (Chelmsford) transmits messages between 7 and 8 p.m. on a 400-metre wave under the call sign 2MT, and between 3 and 5 p.m. on Sundays and 7 and 8 p.m. on Thursdays The Hague gives the *Daily Mail* telephone concerts on a wave length of 1,085 metres, the power being 400 watts and the call sign P.C.G.G.

Radio Telegraphy.—Automatic Transmission at Sea.—A memorable achievement in the history of radio communication has been placed to the credit of the Marconi International Marine Communication Co., Ltd., and the White Star Liner *Majestic*, which arrived at New York on November 14th. On approaching New York the *Majestic* cleared her Marconigrams to the Chatham (Mass.) radio station with high-speed automatic transmitting apparatus, this being the first time that automatic transmission has been used from a liner, and the innovation was made because of the large number of business and private messages which passengers on transatlantic liners desire to send when they are approaching the coast of America. Hitherto only hand transmission has been used by radio operators at sea, but the amount of traffic has recently grown so enormously on the *Majestic* that it has been found necessary to introduce automatic working. The *Majestic* is the first liner to be fitted in this way, and if the Marconi traffic on the other transatlantic liners increases to the extent it has done on the *Majestic* it is probable that they will also be fitted with automatic transmitters. The maximum speed of the automatic apparatus used is 240 words per minute.

Ships' Installations.—The Merchant Shipping, Prevention of Accidents: Safety of Life at Sea, Order in Council, November 3rd, 1922, has been issued (H.M. Stationery Office; price 2½d. post free), further postponing the coming into force of the Merchant Shipping (Convention) Act, 1914, until July 1st, 1923. The Act refers to the compulsory installation of radio apparatus on board ships.

South Africa.—Automatic Telephones.—The Union Government has given a £100,000 contract for automatic telephones to a British firm, says the *Daily Mail*, which explains that the award was made in spite of severe German competition.

Sweden. — Ships' Radio Installations. — The Swedish authorities are strongly enforcing a law prohibiting the operation of radio on foreign ships in Swedish territorial waters within ten nautical miles of a coastal radio station. Under the same decree foreign ships in Swedish harbours may not receive radio messages without the permission of the telegraph directorate.

Syria.—French Radio Co.—Under the name of "Radio-Orient," the Compagnie Générale de Télégraphie san Fils, Paris, France, has organised a subsidiary to handle business with Syria and other Asiatic countries.—*T. & T. Age.*

The Telegraph Service.—Cable Removal.—Post Office engineers have completed the removal, rendered necessary by coast erosion, of the English end of the Beachy Head-Dieppe cable to Eastbourne.—*Daily Mail.*

The Telephone Service.—New Scottish Exchanges.—At a meeting of the Postal Matters Committee of the Edinburgh Chamber of Commerce and Telephone Advisory Committee for Edinburgh recently a report from the district manager of the P.O. Telephone Dept. was received respecting recent telephone developments in the Edinburgh district. A new exchange, called "Museum," will be opened in Edinburgh, with 400 subscribers, to relieve pressure at the Central exchange, and afford more accommodation for new subscribers.

At North Berwick a new exchange has been installed in the Post Office and others have been opened at Ford, Greenlaw, and Longniddry, and new exchanges are under construction at Tarbrax, West Linton, and Kirkliston.

In the city of Edinburgh permission has been received to erect public telephone kiosks. The system of underground wires in Edinburgh has been greatly extended, particularly in the south of the city, and will enable new subscribers to be joined up with greater expeditition. An additional underground cable has been laid between Glasgow and Edinburgh, and is expected to be ready for use early next year.—*Scotsman.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Abertillery.—December 15th. Electricity Department. One 2,200-V, h.b. feeder, one 200-kW and one 30-kW converting sets, h. and l.p. switchgear; static transformers and l.p. switchgear, a.c. overhead and underground distributing system. (See this issue.)

Australia.—Melbourne.—December 20th. Victorian Railways. One 2-ton electric hoist.*

Perth.—January 17th. Postmaster-General's Dept. Telephone and telegraph apparatus, testing instruments, and protective apparatus.*

Barnes. — November 27th. Electricity Department. Turbo-alternator, with surface condenser and auxiliaries, rotary converter and transformer, h. and l.p. switchgear and connections. (November 10th.)

Brandon.—Electric mains in connection with housing schemes at Water houses and New Brancepeth Colliery. Messrs. Hays & Gray, architects, Wingate.

Edinburgh.—December 4th. Electricity Supply Department. One 500-kW converting set. (November 17th.)

Glasgow.—November 28th. Tramways Department. 2,500/3,000 tons steel rails, B.S. Section No. 8; 500 tons fishplates; 1,200 tons special section, 5-in. rail; and 21 tons fishplates. Manager, Tramways Department.

Headington, near Oxford.—December 9th. Board of Guardians. Installation of electric lighting in the infirmaries, &c. (See this issue.)

India.—January 9th. Great Indian and Peninsular Railway Co. Electrification of Bombay suburban lines: Electrical equipment of coaches, overhead equipment of permanent way, and overhead distribution lines. (November 17th.)

Liverpool.—November 27th. Board of Guardians. Electrical supplies for West Derby Union. G. W. Coster, Union clerk, Union Offices, Brougham Terrace, Liverpool.

London.—H.M. Office of Works. December 1st. Electrical and mechanical labour in day work in the Liverpool district during three years from January, 1923. Contracts Branch, H.M. Office of Works, King Charles Street, S.W.

Barking.—December 19th. County of London Electric Supply Co., Ltd. Water-tube boilers for the Barking power station. (See this issue.)

Manchester.—December 4th. Electricity Committee. Two 2,500-kW, one 1,500-kW, and one 1,000-kW rotary converters, with static transformers; or, alternatively, motor converters, with switchgear, l.p. transformer, &c. Four 500-kW automatically-controlled rotary converters and static transformers; or, alternatively, motor converters, complete with the necessary switchgear and full automatic equipment. (November 17th.)

South Africa.—Johannesburg.—December 4th. South African Railways and Harbours Tender Board. Twelve months' supply of electric incandescent lamps.*

Malmesbury.—January 26th. Municipal Council. Electric lighting plant, including two 75-kW d.c. units, boilers, poles, battery, &c.*

St. Helier, Jersey.—Parish Assembly.—Concession for the establishment of an electricity undertaking to supply electrical energy for all public and private purposes within the Parish of St. Helier. (See this issue.)

Warrington.—December 11th. Electricity and Tramways Department. Motors. (See this issue.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

London.—The Edison Swan Electric Co., Ltd., has obtained contracts for the supply of incandescent lamps to the Admiralty, Air Ministry, and Post Office.

South Africa.—Electrification of the Glencoe-Pietermaritzburg section of the South African Railways. Further to our notes on p. 631 of the Electrical Review of November 3rd and p. 751 of November 17th. Contracts have been placed with the following firms:—

Turbo-alternators.—C. A. Parsons & Co., Ltd.
Boilers.—Babcock & Wilcox, Ltd.
Overhead equipment and cables.—Telegraph Manufacturing Co., Ltd.
Switchboard.—A. Reyrolle & Co., Ltd.
Automatic sub-stations.—South African General Electric Co., Ltd.
Automatic telephone exchange equipment for Maritzburg and Port Elizabeth (£100,000).—Siemens Bros. & Co., Ltd.

Yarmouth (Isle of Wight).—Town Trust. Accepted:—
Electric lamps for the pier.—Mr. Tyler, of Newport.

FORTHCOMING EVENTS.

National Association of Supervising Electricians and Association of Engineers-in-Charge.—Tuesday, November 28th. At St. Bride's Institute, E.C. At 7 p.m. Joint lecture, "Where the Electrical Contractor and the Resident Engineer Fail Respectively When Dealing With Electrical Plant," by Capt. A. E. Penn and Mr. T. H. Windibank.

Greenock Association of Electrical Engineers.—Tuesday, November 28th. Visit Berryard's Sugar Refinery, Greenock. Wednesday, November 29th, at 22, West Stewart Street. At 7.45 p.m. Paper on "The Sperry Gyro Compass," by Mr. H. McComb.

Royal Society of Arts.—Wednesday, November 29th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "The Hot-wire Microphone and its Applications to the Problems of Sound," by Major W. S. Tucker, R.E. Monday, November 27th. At 8 p.m. Cantor lecture, "Brown Coal and Lignites," by Prof. W. A. Bone, F.R.S.

Electrical Trades Benevolent Institution.—Wednesday, November 29th. At the Trocadero Restaurant. At 7.30 p.m. Festival dinner.

Northampton Engineering College Engineering Society.—Thursday, November 30th. At the Institute, St. John Street, E.C.1. At 5.30 p.m. Paper on "Cinematography," by Mr. F. L. Best.

Chelmsford Engineering Society.—Thursday, November 30th. At the East Anglian Institute of Agriculture. At 7 p.m. Students' meeting.

Institution of Electrical Engineers.—Thursday, November 30th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Domestic Load Building: a Few Suggestions Upon Propaganda Work," by Mr. W. A. Gillott.

(North-Western Centre).—Tuesday, November 28th. At the Engineers' Club, Manchester. At 7 p.m. Paper by the late Dr. Kapp on "The Improvement of Power Factor," to be read by Prof. M. Walker.

(Liverpool Sub-Centre).—Monday, November 27th. At the University, Liverpool. At 7 p.m. Paper by the late Dr. Kapp on "The Improvement of Power Factor," to be read by Prof. M. Walker.

(North-Eastern Centre).—Monday, November 27th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Domestic Load Building: a Few Suggestions Upon Propaganda Work," by Mr. W. A. Gillott.

(Scottish Centre).—Saturday, November 25th. At the Grosvenor Restaurant, Glasgow. At 7 p.m. Smoking concert.

(South-Midland Centre).—Students' Section.—Thursday, November 30th. At 8 p.m. Visit to the Palais de Dance, Birmingham.

Junior Institution of Engineers.—Friday, December 1st. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Machines Used in Magnetic Separation," by Mr. H. G. Brown.

Electrical Power Engineers' Association (Southern Division).—Friday, December 1st. At the Institution of Electrical Engineers, Victoria Embankment. At 7 p.m. Lecture on "The Scope of Publicity in a Public Service," by Mr. J. W. Beauchamp.

British Electrical Development Association.—Friday, December 1st. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Second lecture on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," by Mr. W. Attwood.

Institution of Mechanical Engineers.—Friday, December 1st. At the Institution, Storey's Gate, S.W. At 6 p.m. Thomas Hawksley Lecture, "Some Recent Researches on Lubrication," by Dr. T. E. Stanton.

London Electrical Engineers' Old Comrades' Association.—Friday, December 1st. At the Bridge House Hotel, London Bridge, S.E. At 7.30 p.m. Bohemian concert.

Association of Consulting Engineers (Incorp.).—Wednesday, December 6th. At St. Stephen's Club, Westminster. At 7 p.m. for 7.30 p.m. Annual dinner.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

To enable us to complete replies to queries received this week, we need the names of manufacturers or suppliers of :—

Porcelainite cement for fixing insulators to their supports.
The Chatterak telephone holder.
Helia Pressel switches.
Polarlite lamps.
Lissun insulating paper.

NOTES.

Model Engineers' Social.—An excellently-varied conversazione was organised by the Society of Model and Experimental Engineers at the Caxton Hall, Westminster, on November 18th. One of the most interesting features was an exhibition of members' work, in which patience and ingenuity were well represented. Among the exhibits were model boats and locomotives, miniature motors and dynamos, complete generating sets, wireless apparatus, and electric clocks. A number of firms of toolmakers and engineers also had displays, several small lathes of good design being present. Wireless apparatus was shown by Messrs. Leslie McMichael, Ltd., and Radio Instruments, Ltd. During the afternoon the Rouge et Noir quartette rendered musical items in the Council Chamber, and after tea was served there were exhibitions of "magic" and a lantern lecture describing a motor tour through Kent and Sussex. From 7 to 11 p.m. dancing was the principal attraction, while for non-dancers a concert was given by a capable party in the Council Chamber. The arrangements were admirable, showing careful "staff-work on the part of the Secretary, Mr. F. H. J. Bunt, and his assistants.

Water Power in India.—At a meeting of the Royal Society of Arts (Indian Section) on November 17th, Mr. J. W. Meares, C.I.E., &c., read a paper upon "The Development of Water Power in India." Sir Thomas H. Holland, K.C.S.I., &c., was in the chair. In his paper Mr. Meares briefly reviewed the history of the subject, commencing with small developments in the Darjeeling district when water power was used both directly and electrically. Two of the original hydro-electric plants were still working. There were no further developments until early in the present century, when the Cauvery plant in Mysore was erected to meet the demands of the Kolar Gold Fields. The first Indian Electricity Act (1903) was drafted by Mr. Meares while electrical engineer to the Bengal Government, and two years later he was appointed electrical adviser to the Government of India. Several hydro-electrical schemes were brought into being during the first decade of this century, including that at the Mussoorie Hill station. In India difficulty is experienced on account of unforeseen floods, which may occur only once in as long as 90 years. A great landmark in the history of Indian water power was the commencement of the Tata Hydro-Electric Power Supply Co., which took the development of the Western Ghats water power in hand. The present Electricity Act became law in 1910, which, with its subsequent amendments, is acknowledged to be an up-to-date enabling Act with little red tape about it.

The first Hydro-Electric Survey was due to the foresight of Sir Thomas Holland, but owing to the ineptitude of the officials of local Governments it came to nothing, the information supplied being vague and useless. The first useful survey was commenced in 1918, and since then three reports (which have been reviewed in our columns) have been published. It is safe to say that at least 7,000,000 e.h.p. is in sight on the most conservative estimate, and on the basis of absolute minimum continuous power.

The inertia of local Councils has retarded development to an enormous extent by refusing to vote funds for the work. They appear to be quite content with their present state and look suspiciously on Western innovations.

Mr. Meares agreed with Mr. Arnall that the present interest rate of 4 per cent. allowed to be paid out of capital during the constructional period is not sufficiently attractive to capitalists and requires amendment.

The statistics of available power, &c., given in the Triennial Report (Elec. Rev., April 28th, 1922, p. 604) were summarised in the paper, and the speaker exhibited a map showing the distribution of water power in India.

In the course of his paper, Mr. Meares spoke of the lack of regard shown by the Government to the sanctity of contracts. He instanced a case where a number of engineers were engaged on a three-years' agreement, the Government promising to pay their passages out and home. After about five months it was found impossible to proceed with the work for which they were engaged, and so they were discharged with six months' notice, and the provision of money for their passage home was refused. He was glad to state, however, that upon appeal the Secretary of State ordered the payment of the passage-money for their return.

The chairman, in the course of some comments upon the paper, said that the coal deposits of India were being depleted to an extent which was causing grave anxiety. The exploitation of oil was increasing at a greater rate than the discovery of fresh sources. There was, therefore, an urgent need for water power development, but unless the Indians themselves supported hydro-electric schemes industry would ultimately fail altogether. He said that in all schemes irrigation systems would have to be studied, as any development might easily upset the carefully balanced formulæ.

Broadcasting and Acoustics.—In connection with the commencement of the official broadcasting service, a correspondent points out that one peculiar fact which has become apparent is that the acoustics of the room in which the transmitting apparatus is installed affect the actual transmission to an appreciable degree at times. A necessary preliminary to the obtaining of the best results will be the perfecting of the acoustic qualities of the transmitting room. Many things combine to make up the acoustic properties of a room—size, furniture, shape, &c. The transmitting room of one of the broadcasting stations now operating has a bare stone floor and bare walls. Worse conditions could not be imagined from the acoustical point of view. Though the reception from this station is splendidly loud, a great improvement in clarity and sonority of volume would be obtained by furnishing the room in the right way. At present there is a persistent ringing tone in reception, due undoubtedly to the heavy reverberation of sound waves in the transmitting room. This defect is very noticeable when strident music is being played. Numerous amateurs who have been receiving broadcast music at short range are experiencing difficulty in reducing the volume of sound to a comfortable minimum, especially when only head telephones are used. The loudness is sometimes painful and the usual methods of reducing strength are futile. One effective remedy, however, is to cut out reaction altogether. An aerial tuning inductance slightly larger than that designed for the actual wavelength concerned sometimes gives the desired diminution, and a large capacity condenser placed across the coil will facilitate tuning.

Automatic Train Control.—Lt.-Col. A. Mount, reporting to the Ministry of Transport upon an accident at Northampton (L. & N.W. Rly.), on August 26th, says that this was another illustration of the class of accident which would have been prevented by an automatic train-stop at the signal concerned. It appears that a passenger train shortly after leaving Northampton, ran into the rear of a goods train which had left the station some time before, derailing the brake van and four rear wagons. Immediately afterwards, an express goods train travelling in the opposite direction collided with the wreckage and its engine and front wagon were derailed. A further mishap was averted by the promptness of a signalman in pulling up an oncoming passenger train. Investigation established that the goods train with which the passenger train collided had been standing on the line for an hour after having been moved back past the "home" signal at Northampton. The signalman responsible for passing the passenger train through, was not aware that the goods train had been moved back, but he had put his signal at danger to hold up the train until a Northampton—Rugby fast train had passed. The driver of the former train failed to observe the signal, however, and ran on until his engine collided with the standing goods train.

The Electro-Harmonic Society.—The Ladies' Night concert, held at the Caxton Hall on Tuesday last week, was well attended, and proved very successful; Mr. Frank Gill, President I.E.E., occupied the chair, and there was a strong programme. Vocal items predominated, and perhaps it was partly for that reason that the only instrumental pieces—violin, 'cello, and pianoforte trios, by the Misses May—were especially appreciated. The new hall was more comfortable and homelike than that occupied last year, and with a little improvement in respect of attention to draughts should serve the Society well—in default of a larger one.

Russian Electrical Ploughs.—The Elektrozem is undertaking a number of experiments on a large scale with electric ploughs prepared by the Briansk works, in the district of Bogorod, where 250 dessiatines of land will be ploughed up. Experiments will be undertaken in other districts, as in the Government of Samara, where deep ploughing is required and where the land is very heavy, requiring careful ploughing for sugar-growing. Experiments will also be carried out in the Kostrom Government for grass-growing. At the same time, it is announced that a number of agreements are being drawn up for the electrical equipment of farms; and one with the Zootechnical Institute for similar equipment on the experimental fields at the station of Veschky on the Moscow-Windau Railway.

A "Wireless" Insurance Policy.—A radio installation carries with it certain elements of risk, and is a very suitable subject for insurance, but there has hitherto been no special policy issued which completely covers the ground.

The Liverpool Marine and General Insurance Co., Ltd., has therefore issued a special prospectus which offers a policy at a moderate premium, covering the apparatus itself, including outside aerials and supports, to provide compensation for damage arising from numerous risks to which it is exposed, and also to indemnify the owner in respect of claims for compensation for personal injuries to or damage to property and goods of third parties, caused or alleged to be caused by breakdown of the aerials, supports, or any part of the installation.

Such claims arise in a variety of ways—to the outside aerial. standards or attachments, by lightning, storm, tempest, and malicious damage, and to the whole set by fire, lightning, burglary, housebreaking, larceny and other perils.

Third party claims are frequently a source of considerable trouble and may involve legal proceedings before a settlement is arrived at, and it is desirable to transfer the liability to an insurance company.

It is claimed that landlords will usually withdraw any opposition towards the erection of aerials on buildings on proof that the tenant is insured against damage to the building.

The object of the insurance is to provide, not against the inevitable, such as the wearing out of parts of the apparatus, but to afford provision for the multitude of risks, some undoubtedly serious, outside the control of the insured person.

Electrical Power Engineers' Association.—The fourth annual dinner of the South Coast Section of the Association was held at Brighton on November 11th. Mr. W. J. Jeffery (president) occupied the chair, and the guests included the borough electrical engineeers of Brighton, Hove, Eastbourne, and Bradford, and members of local Corporation committees. Dr. Smith (Hove), in proposing the "Health of the Association," commended the excellent educational work it was carrying on, and made special reference to the high standard of the *Journal*. In reply, Mr. Jeffery said that their previous unorganised state was bad for the industry and for themselves. The Association had done much in the stabilisation of the industry. Mr. Cleary proposed the toast of "The Visitors," and Councillor Galliers (Brighton) and Mr. Bridges (Eastbourne) replied. The latter spoke of the importance which the Brighton undertaking would probably possess in the near future. Either Brighton or Hastings would eventually take over the Eastbourne undertaking. An excellent musical programme was provided.

Industrial League and Council.—The annual meeting of the above organisation is to take place on Wednesday, December 6th, at the Holborn Restaurant at 5.15 p.m. The annual dinner takes place at 7 p.m. The annual report for 1921-22 has just been issued.

Service Notes.—Major K. W. E. Edgcumbe, T.D., M.I.E.E., M.I.C.E., late of the London Electrical Engineers, has been appointed lieutenant-colonel of the new 11th Battalion A.A. Corps of Royal Engineers, from the 6th ult. Lieutenant-Colonel Edgcumbe was long associated with the London Electrical Engineers before the great war. He was promoted to field rank the month before the war broke out, and served in that rank and as temporary lieutenant-colonel. A number of subalterns who served with various electrical units, electric light companies, &c., in the war have been appointed to the Territorial Reserve of Officers. Amongst volunteer ratings called upon for instruction are some 50 petty officers to be trained as submarine detectors in the use of the very delicate apparatus employed therefor; also for instruction in radio telegraphy. Warrant Electrician F. R. Darley has been posted to the battleship *Emperor of India* on recommissioning from the 21st inst.

Dinner.—The annual dinner of the Apprentices' Association of the General Electric Co., Ltd., Witton, was held at the Magnet Club, Erdington, on November 21st. Many ex-members of the Association and ex-apprentices were present.

Fog Prevention.—Mr. Harris moved the following resolution at the meeting of the London County Council on Tuesday:—"That it be referred to the Public Control Committee to consider and report how far fog in London is caused by the pollution of the atmosphere due to preventible causes; whether by a larger use of electricity for power and other purposes the atmosphere of London might be improved, and whether any and, if so, what further powers are required to deal with the emission of smoke in London."

Mission-airies.—Radio telephones and aeroplanes are to be used in hitherto inaccessible parts of China by missionaries of the Methodist Episcopal Church, says the *Daily Express*.

Electro-Farming.—A lecture on "How Electricity Helps the Farmer," is to be given on November 25th, at the Bedford Park Club, W., by Mr. H. A. Carney.

What is "Bulk" Supply?—The *Industrial Australian and Mining Standard* says that the Victorian State Electricity Commission defines the term "bulk supply" as either "an unusually large supply to a single consumer, or a supply to a distributing authority, such as a municipal council or a private corporation." This is the Commission's own definition of a term that is universally accepted as meaning a supply for re-sale, which is a very different thing. It has long been recognised by those conversant with the policy of the Commissioners that they have definite ambitions regarding distribution of electricity. If this definition is accepted, the Commission has authority to enter a district, otherwise unprotected, and supply any consumer, and thus undermine the commercial soundness of the undertaking, this eventually resulting in the taking over of distribution by the Commission. There is no explanation as to what is "an unusually large supply," and this also can be determined by the will of the Commission. There is evidence to lead one to suppose that the Commission at present regards a few kilowatts as "an unusually large supply," but this detail can obviously be adjusted at any time to suit circumstances as they arise.

Church Telephones.—Telephones for deaf members of the congregation is the idea of one of Eastbourne's preachers, the Rev. James Reid. He is installing in the pulpit of the Presbyterian Church a transmitter, which will carry his voice to receivers in the pews of those who need them. A committee is at present carrying out the plan, which has met with the enthusiasm of many who have hitherto found it impossible to hear, says the *Evening News*, a correspondent of which points out that while in Holland about 18 months ago he saw a similar arrangement at the church of Brock-in-Waterland, one of the "dead" cities of Holland.

X-rays from the Sun.—The French scientist, M. Henri Deslandres, director of the Paris Physical Astronomical Observatory, at a meeting of the Academy of Sciences in Paris appealed for international co-operation in a matter of great interest.

Rays of great penetrative power, including X-rays and radiations of high frequency, are known to be emitted by the sun and stars. The high-frequency radiations may give rise to signals which are received by radio equipment from time to time on the earth and have so far baffled the electrical experts.

These celestial radiations form only a very small part of the energy shot out by the sun and stars, but they possess many remarkable electrical properties. Some of their effects have been measured at an altitude of 30,000 ft. (nearly 6 miles), and M. Deslandres suggests that these experiments should be repeated at several points of the earth at the highest possible altitude. Such experiments would be costly and the co-operation of the various nations would be essential to their success.

The Western Union Telegraph Co., North America, estimates that the disturbances connected with sunspots caused it a loss of £50,000 last year. It has, in consequence, decided to establish an astronomical section of its own to develop a system of precautions against sunspot disturbances.

Arrangements have been made with the United States Naval Observatory for a regular bulletin service on the condition of sunspots. In return for this service, the Western Union is preparing to collect information on a large scale on electrical currents, their strength and direction, and their apparent connection with sunspots.—*Daily Mail*.

The Marine and Small Craft Exhibition.—The Marine and Small Craft Exhibition and Congress began at the Royal Agricultural Hall on November 14th, and the exhibits, which fulfil every need of the yachtsman, included a collection of practical small craft. On the 15th inst. H.R.H. the Duke of York performed the formal opening ceremony by means of radio telephony from Buckingham Palace, and amongst the subjects dealt with at the Congress meetings was that of the "Equipment of Small Yachts with Wireless Apparatus," by Commander J. A. Slee, C.B.E., R.N. (Ret.) (Marconi International Marine Communication Co., Ltd.).

Amongst the exhibits of Mr. Geo. Spicer (Brentford) was a motor launch fitted with an aerial and a three-valve radio re-

ceiver by the Wilton Wireless Co.; he also showed two marine engines, a 25-h.p. Sterling and a 45-h.p. Kermath, both of which were provided with electric starters.

Messrs. Autoveyors, Ltd., had a large display of radio components, accessories, "loud-speaking" attachments, aerials, &c., suitable for use on small craft, punts, and houseboats; also cabinet type, valve, and crystal receivers, amplifiers, transmitters, &c., the firm being a distributing agent for nearly a dozen British manufacturers of radio equipment. In the centre of the hall a number of "loud-speaking" horns was suspended, and the firm demonstrated the reception of speech and music successfully.

Messrs. Edison Accumulators, Ltd. (London) had on view samples of all-steel accumulators, such as are used for ignition and lighting on small craft, for yacht lighting, and similar purposes.

Messrs. Dixon Bros. & Hutchinson, Ltd. (Southampton), showed amongst other engines a paraffin set coupled direct to a 1.5-kW generator.

The Langdon Engineering Works (Southampton) exhibited three sizes of petrol and paraffin electric lighting sets, the capacities being 1 kW, 11 h.p. at 35 V, and 14 A at 100/135 V, the generators being of various makes and connected direct to the engines.

The Evinrude Motor Co. (Eng.), Ltd. (London), showed two house-lighting sets, each being complete with a slate switchboard and a battery of accumulators. The larger "Madstrong" will produce 20 A at 40 V and 1,200 r.p.m., while the smaller "Evenlite" has a capacity of 500 W at 25 V and 1,000 r.p.m.

The London Electric Firm (Croydon) exhibited a petrol-electric generating set having an output of 500 W for yacht lighting, &c., in addition to a selection of searchlight and signalling projectors suitable for use on small craft that are fitted with electrical installations. The arc lamps are provided with a hand or automatic feed as required, or for lower voltages metal-filament lamps may be used. On this firm's stand, lamps, lamp-lowering gear, electric irons, kettles, stoves, and an electric soldering iron heater were to be seen.

The Electrically-propelled "Maryland."—Another record of the superiority of electric propulsion has been established. When returning from the Centennial Exposition of Brazil, the all-electric U. S. battleship *Maryland* made the 4,760-mile run from Rio de Janeiro to New York in ten days, seventeen hours, and fifty minutes, thereby breaking the former record.

However, the matter of eight hours' difference in running time by no means expresses the full significance of the new accomplishment, for this is revealed only on consideration of the vastly different weather conditions under which the two runs were made.

The best time of the *American Legion* was made in favourable weather; while the *Maryland* for nearly two days had to proceed against 75-mile-an-hour hurricanes. The violence of the ordeal is described in the *General Electric Review*, which points out that the high-speed endurance run of nearly 4,800 miles through tropical waters at an average sustained speed of 18.48 knots with a final spurt for four hours at 21 knots reflects especial credit on the engineer officers.

The chief importance of the voyage, so far as naval designers are concerned, lies in the fact that the *Maryland* is electrically driven and controlled and that the success of the run probably will determine that this form of power shall be utilised to operate many American battleships of the future.

"The long voyage provided an excellent test and proved that the *Maryland* can be handled with the greatest efficiency and economy," was Secretary Hughes' comment on the battleship's performance.

"I did not realise until this trip how superior the electric drive is to anything else," said Admiral Hilary P. Jones.

"The storm proved the value of the electric drive," said Captain Sellars. "That is automatically regulated, so no matter what seas we plough into the speed of the ship is maintained. During the storm we sometimes brought up against seas as if they were brick walls, but the *Maryland* went right through them. We only lost 0.8 of a knot at any time during the worst of the blow.

"When we ran up against seas that checked our way there was 8,000 more h.p. generated to bring the speed up to the normal 18 knots and keep it there. The automatic governor takes care of that, and all that is necessary is to set the motors at the desired number of revolutions, and they keep that speed. There is no racing, either, when the screws lift from the water.

"The ship picked up like a subway express; 800 yards from our anchorage we were doing eighteen knots."

While the foregoing enthusiastic comments were made with reference to her recent remarkable voyage, it is worthy of note that the satisfaction with her electric propelling machinery dates back to her builder's trials in June, 1921.

Cast Iron Research.—The British Cast Iron Research Association has published its first annual report, covering the year ended on June 30th last. It is stated that although there are 3,000 foundries engaged in the production of grey or malleable cast-iron in this country, only 202 of these have become members of the Association in spite of persistent propaganda. This is attributable in a large measure to the bad state of trade. The Council recommends the division of the country into sixteen foundry areas, each to have one representative on the Council for every hundred foundries. Sixty-six meetings of the Council and committees have been held during the year in Manchester, London, Sheffield, and Birmingham. Research, which is limited by finance, is being carried out in nine main directions. The year's work has included researches upon moulding sands and refractories, malleable castings, internal combustion engine cylinder castings, and shrinkage defects. Other ways in which the Association has been active include educational schemes, and the collection and arrangement of periodical information.

National Association of Supervising Electricians.—In continuance of this session's educational programme, the N.A.S.E. held a meeting at the St. Bride's Institute on November 14th, at which Mr. H. A. Hankey, of Marconi's Wireless Telegraph Co., Ltd., delivered a lecture on radio telegraphy and telephony, and demonstrated broadcast reception.

The fascinating nature of the subject attracted a very large audience, and the speaker had an intimate acquaintance with his subject. The lecture commenced with an explanation of the fundamental principles of the radio art, and by means of diagrams the nature of the types of waves employed was made clear. Mr. Hankey was very skilful in his method of steering a course between technicality and the elementary—a very difficult matter with such a subject. A number of lantern slides were exhibited, which gave an excellent impression of the magnitude which radio telegraphy and telephony have attained, views being shown of the Carnarvon and other large stations erected by the Marconi Co.

A special feature of interest was the description and views of the Inchkeith "radio lighthouse," dealt with by Mr. Franklin in a paper read before the I.E.E. last session. This is able to indicate the proximity and direction of a danger point to vessels at sea, by means of directional short-wave radio-telegraphy, over a range of about ten miles.

The lecturer dealt with the importance of the thermionic valve and explained its construction and action. The demonstration of telephonic reception was given with the aid of a simple single aerial, stretched from one end of the hall to th other, and a multi-valve receiver and loud speaker. The evening marked the commencement of official "broadcasting" from Marconi House, but owing to certain questions relating to copyright, &c., it was only possible to distribute items from the evening newspapers, during two separate half-hours. The result was very successful and speech was as clear as the present form of loud speaker allows.

The lecturer had numerous questions put to him by members of the audience, all of which he answered very satisfactorily. He said that the use of an insulated-wire aerial was of doubtful advantage judging by his own experience. He also expressed doubt as to the efficiency of a lighting installation when employed as an aerial.

The chairman, Mr. W. E. Highfield, in proposing a vote of thanks to Mr. Hankey, traced the growth of telegraphy and telephony and said that the radio art still had endless possibilities.

Atmospheric Energy.—In a letter to *The Engineer*, Mr H. R. Kempe works out the energy stored up in the atmosphere, on the basis that one cubic foot of air, expanding into absolute vacuum, could give out 5,188 foot-pounds. He finds that the energy contained in a layer of air one foot deep over the whole surface of the earth is 1.13×10^{23} foot-pounds, which is sufficient to produce 1,000,000 horse-power for 6,530,000 years.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Hon. Member.—At the meeting of the Institution on November 16th it was announced by the President that the Council had that day unanimously elected Prof. John Ambrose Fleming, M.A., D.Sc., F.R.S., of the Pender Electrical Laboratory, University College, London, an honorary member of the Institution.

Informal Dinner.—It has been arranged for members of the Institution to dine together informally on December 7th at the Engineers' Club. Members who desire to be present should inform the secretary as early as possible of their intention.

Liverpool Sub-Centre.—A popular lecture on "Broadcasting" was given in the Arts Theatre of the University by Mr. A. P. M. Fleming, C.B.E., M.Sc., to members and friends, totalling 625, on November 13th.

North-Eastern Centre.—*Students' Section.*—A meeting of the North-Eastern Students' Section was held at Newcastle on November 10th, when Mr. F. G. C. Baldwin, chairman of the North-Eastern Territorial Centre, gave the students an address on "Efficiency." Mr. W. N. Kilner was in the chair, and there were present 42 members and two visitors. The next meeting is on December 1st, when Mr. W. Owen will lecture to a joint meeting with the North-East Coast Institution of Engineers and Shipbuilders and the Mining Institution, on "Distortion in Wireless Telephony."

Scottish Centre.—At a recent meeting of the Scottish Centre, when Mr. A. S. Hampton, president, delivered his inaugural address, the subject dealt with was the economic aspect of railway electrification. Mr. Hampton pointed out that the electrification of railways had improved the position so far as short-haul traffic was concerned, and, generally speaking, the existing electric lines had adjusted themselves to paying their way and creating new traffic. Mr. Hampton also referred to the greater utilisation of the available water power in Scotland, and pointed out that there was a limit to the length of the transmission line and a point at which the advantage of the hydro-electric power station was wiped out. The lecture was illustrated with a number of lantern slides.

East Midland Sub-Centre.—At the third meeting of the 1922-23 session of the Sub-Centre at Loughborough, on November 21st, a paper was read by Prof. W. Cramp, D.Sc., entitled "Some Recent Research in Electrical Engineering," in the course of which the construction and use of a balance for the accurate determination of field intensity, reading to one line per square centimetre, was described, including the use of the balance to prove the Biot-Savart law. The effect on the characteristics of an induction motor of including in the rotor circuit extra self-induction, such as is the case when a machine is used as a synchronous induction motor was explained, as were also tests carried out upon the action of a new balance dependent upon a radio-active disk. A comparison was made of two commercial rectifiers, namely, (*a*) the Tungar rectifier, which depends upon the ionisation produced by a tungsten filament, and (*b*) the J. and P. rectifier, which depends upon purely magnetic and mechanical principles.

A new mine signalling system, designed by Mr. G. M. Havey, with the object of getting rid of the contact spark by making the circuit non-inductive by the use of a thermionic valve was described; also a method of measuring and recording the received signal strength in radio telegraphy, depending upon the measurement of the change in the anode current by means of an Einthoven galvanometer with a special balancing arrangement. The calculation of the eddy currents in the sheaths of single core lead-covered cables was dealt with. More accurate methods of predetermining the flux in the air path of a magnetic circuit were pointed out, and a comparison of these with older approximations was made.

Institution of Mining Engineers.—The thirty-third annual general meeting was held on November 16th and 17th. The re-elected president, Prof. Sir John Cadman, K.C.M.G., D.Sc., in his address, reviewed the progress of this branch of engineering, showing how the improvement of mechanical appliances in mining had multiplied the output and reduced the casualty rate. With the Institution of Mining and Metallurgy the Institution had decided to form an Empire Council of Mining and Metallurgical Engineering. The sister institutions in the British Isles and the Dominions would be invited to co-operate and become equal partners. The objects of the Council would be to promote safety and economy; to raise the professional status of the mining engineer; to convene periodical congresses, &c. The president was confident of the success of the scheme.

Birmingham and District Electric Club.—Members of the Club paid a visit to the Witton works of the General Electric Co., Ltd., on November 10th, and were much impressed with the resources of the works, and were particularly interested in the development and research laboratories and the new 22,000-kVA set under construction for the Birmingham Corporation. After the visit the usual monthly meeting was held, when there was an animated discussion upon the paper read at the previous meeting by Mr. F. R. Unwin, A.M.I.E.E., on "Alternating Current Apparatus." The discussion centred largely on the question of unity power factor.

Chelmsford Engineering Society.—On November 9th a lecture on "Wireless Telephony" was delivered by Mr. H. M. Dowsett, M.I.E.E., chief of the Testing Department, Messrs. Marconi's Wireless Telegraph Co., Ltd. The lecturer lucidly explained various types of transmitting microphones and the latest type of transmitter which will be used at Marconi House for broadcast telephony. The interest of the lecture was considerably added to by lantern slides, which were specially prepared, included in which were slides showing the latest types of transmitters with their theoretical diagrams of connections, also receiver diagrams. The lecture concluded with a description of the various types of receivers suitable for the reception of telephony, and during the evening concerts from Writtle and Marconi House were heard with the aid of frame aerials and three independent loud speakers.

Radio Association.—A meeting of the trade section of the Radio Association was held at the Hotel Cecil on November 20th as a result of a previous meeting of the Association on November 10th, which was attended by a large number of radio manufacturers and traders. At that meeting the necessity for immediate steps to be taken in order to protect the special interests of manufacturers and traders were clearly manifested. The second meeting formulated a plan of campaign to attain this end, and discussed the best way of taking up with the Broadcasting Co. and the Postmaster-General such matters as are likely, it is said, to be a menace to the welfare of the radio industry of this country. The meeting was called to confirm resolutions passed at the previous meeting, to nominate additional members of the *pro. tem.* Committee (Trade Section), and to issue instructions to the committee for immediate action.

It was an entertaining meeting, says the *Daily News*. After Prof. A. M. Low and Colonel L'Estrange Malone had explained the object, members of a second body—the Wireless Manufacturers' and Traders' Association—protested that they had a committee which had been waiting for six weeks to meet the Radio Association. After a lively discussion the secretary of the Traders' Association virtually took the meeting out of the hands of the Radio Association, and an entirely new association was formed. Members of both the other organisations were recommended to join it at once. A committee was immediately appointed to draw up plans of action against what was described by a speaker as "the dictation of the Marconi people." A manufacturer then announced that yet another association for British manufacturers only would be in being in a week or so. After this the meeting broke up, leaving the elected committee in session. The amalgamation of the Wireless Manufacturers' and Traders' Association with the Radio Association was agreed to, the name of the new association to be "The Radio Manufacturers' and Traders' Association, Ltd., by guarantee."

Greenock Association of Electrical Engineers.—A large attendance of members greeted Mr. S. A. Stigant, A.M.I.E.E., when he read his paper on "Transformer Breakdowns." The subject was treated very fully, and numerous lantern illustrations of actual breakdowns, electric wave phenomena, graphs of mechanical stresses, &c., clearly demonstrated the lecturer's points. Protective devices and oils were also discussed.

Faraday House Old Students' Association.—The annual dinner of this Association was held at the Hotel Cecil on November 17th, Mr. P. V. Hunter, C.B.E., president of the Association, being in the chair, and amongst those present were:—Mr. Ll. B. Atkinson, Sir Tom Callender, Mr. R. S. Downe, Dr. W. H. Eccles, F.R.S., Dr. Ferranti, Mr. F. Gill, Mr. Haydn T. Harrison, Sir Ernest Hughman, Mr. R. W. Hughman, Mr. W. W. Lackie, Colonel Morcom, Mr. A. Page, Mr. G. W. Partridge, Mr. C. C. Paterson, Mr. G. Scott Ram, Dr. A. Russell, Captain H. Riall Sankey, Mr. A. M. Sillar, Mr. F. E. Smith, F.R.S., Mr. W. O. Smith, Sir John Snell, Mr. C. D. Taite, Mr. C. P. Sparks and Mr. C. H. Wordingham. The toast of "Faraday House and its Old Students" was proposed by Mr. Gill. Dr. Russell, in reply, stated that the College had a very successful year, and quoted interesting and instructive figures with respect to the war service students sent to the College by the Government, showing that the money had been well expended. Of 72 who had completed their training at Faraday House, 68 had been placed in appointments in the engineering industry, and four were now waiting to obtain posts. The College sports teams were flourishing, and although the theoretical course only lasted two years, yet several of the students took the London B.Sc. in engineering, two of them taking honours last year. They had also been successful in the open competition for posts in the Engineer-in-Chief's Department of the Post Office. He attributed much of their success to the wholehearted co-operation of the many important engineering companies and borough electrical undertakings to which the College is affiliated. Mr. C. D. Taite proposed the "Guests," and Sir John Snell and Captain Sankey replied. Finally, Sir Tom Callender proposed the toast of "The Chairman" (Mr. P. V. Hunter), who made an interesting and amusing reply. An excellent musical entertainment finished up a most enjoyable evening.

"Old Centralians."—A meeting of the Old Students' Association of the City and Guilds' Engineering College, Manchester Local Branch, and a smoking concert will be held at the Grand Hotel, Manchester, on December 1st, at 7.30 p.m. Tickets, 2s. 4d. each, may be obtained from Mr. J. P. Clifton, "Cargill," Springfield Road, Sale, or the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.

Junior Institution of Engineers.—"The Development of Ball and Roller Bearings" was the subject of a lecture delivered by Mr. A. W. Macaulay at the Institution Rooms on November 10th. The lecturer commenced by referring to the recent contributions of Messrs. Palmgren and Heathcote, and, after briefly describing the progress of development and design of both types of bearings during the past 20 years, offered tentative suggestions for commercial tests. Four principal suggestions for the conditions under which the commercial tests should be carried out were (1) to submit the bearing to 100 hours' continous running under pure radial load at 1,000 r.p.m., with the intention of subjecting the balls and races to such a number of revolutions in a reasonable time as would just produce flaking from excessive fatigue, the result to be the average obtained from at least half a dozen bearings; (2) the test load to be twice the listed capacity; (3) the probable life under other loading to be derived from the cubic law, *i.e.*, the life at normal listed load (half test load) would be 800 hours, and so on; (4) these severe conditions representing an admission of a definite life to a bearing must be considered in relation to the majority of applications in actual service.

Appointments Vacant.—Switchboard attendant for the Newport Corporation Electricity Dept.; junior switchboard attendant for the L.C.C. Tramways Dept. (See "Official Notices" to-day.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

SENATOR MARCONI, who has been ill for the past three weeks, is still unwell, and has been compelled to cancel all engagements for the remainder of this month.

It is stated that Mr. NEVILLE CHAMBERLAIN, M.P., has resigned his seat on the boards of the Birmingham Small Arms Co., the Daimler Co., and Elliotts Metal Co. on accepting the office of Postmaster-General.

Bailie TAYLOR, who has just been elected Provost of Cumnock, after being a member of the Council for 16 years, took over in 1901, in partnership with his brother, the business of George M'Cartney & Co., which has added many departments to the business since the date mentioned, and is manufacturing the "Orb" electric switches. Provost Taylor has charge of the commercial side of the business.

Mr. A. F. HARRISON, of the City of London Electric Lighting Co., Ltd., has been appointed a vice-president of the Chartered Institute of Secretaries.

Sir ROBERT HORNE, K.C., M.P., who held the office of Chancellor of the Exchequer and various other offices in the late Government, has been elected a director and vice-chairman of Baldwins, Ltd.

The *Daily Dispatch* of Manchester announces that an important change in the personnel of the Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, has been made by the appointment to the chairmanship of Sir Philip Nash in place of Mr. J. Annan Bryce, who has been the chairman of the British Westinghouse Co. (now Metropolitan-Vickers) for a good many years, and is retiring on the ground of ill-health. "It is understood that Sir Philip will take an active part in the control of the company. Sir Philip Nash is one of the best-known locomotive engineers in the country. He was head of the Great Northern locomotive department, and from 1899 to 1915 chief in the same department for the East Indian Railway. He rendered valued service to the Ministry of Munitions, and in 1916 became Deputy Director-General of Transport in France. He is a member of the Institute of Civil Engineers, and holds distinguished Belgian, Italian, and American Orders for various services."

Mr. L. F. BICKELL, city electrical engineer of Port Elizabeth, South Africa, is visiting Great Britain, and expects to arrive about January 8th. He requests that any communication be addressed to him c/o Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C.

Mr. F. T. HOMAN, chief assistant engineer to the Northampton Electric Light & Power Co., Ltd., has been appointed deputy engineering agent, Calcutta, to the Calcutta Electric Supply Corporation, Ltd.

The marriage took place on November 17th of Mr. TREVOR F. D. ROSE and Miss IRENE PHYLLIS HIRST, younger daughter of Mr. and Mrs Hugo Hirst. In the large company at the reception in Claridge's Restaurant were Lord and Lady Ashfield, Major-General Sir Newton and Lady Moore, Lady Harris, Sir William Noble, Sir John Hewett, Sir Malcolm and Lady McAlpine, Colonel Grant Morden, M.P., Mr. Gordon Selfridge, Mr. and Mrs. A. W. Gamage, Captain Hughes Hughes, Mr. David Gilmour, M.P., Mr. and Mrs. Montague Armstrong, Mr. and Mrs. M. J. Railing, Dr. A. H. Railing, Miss Megan Lloyd George, Mr. and Mrs. Richard Jack, Mr. and Mrs. Llewellyn Atkinson, Mr. C. H. Wordingham, and Mr. J. S. Highfield. Altogether some five hundred guests were present. After the reception Mr. and Mrs. Rose left for a tour on the Continent.

Mr. F. A. PARNWELL, assistant general manager of the Great Eastern Railway, has been appointed general manager in place of Sir Henry Thornton, who is going to Canada.

There were thirty-four candidates for the position of manager of the electricity undertaking in Portrush in succession to Mr. Grosse, who had resigned. At the Council meeting last week seven applicants were chosen, and the final selection will take place this week.

While seated in a train, returning from a meeting to his residence at Dundrum, Co. Dublin, Mr. L. RAUL, chairman of the Dublin City Electricity Committee, was placed under arrest by Free State troops and conveyed to Wellington (military) barracks. It is not stated whether any charge has been made against him. MR. MCENTEE, consulting engineer for many electricity schemes in Ireland, was taken into custody at the same time by Free State troops. So far as is known, no charge has yet been preferred against him.

Mr. W. J. BELSEY, who has been manager of the British Thomson-Houston Co., Ltd., Glasgow office, since 1905, has been transferred to the head office at Rugby as manager of the marine department, and Mr. J. MILLER has been appointed to succeed him as manager of the Glasgow office.

Mr. B. H. JENKINSON, senior partner in the firm of Jenkinsons, consulting engineers, Gray's Inn Square, W.C., has been elected for the second year in succession as Mayor of Hornsey. The Town Council at the same time elected him to the position of Alderman of the borough.

Obituary.—MR. W. H. SMITH.—Last week we referred to the death, after a long and painful illness, of Mr. W. H. Smith, who for many years was manager of the Liverpool branch of Simplex Conduits, Ltd. The large number of floral tributes sent, and the presence of many representatives of electrical firms at the church and the cemetery at Walton on November 9th, showed in what high esteem Mr. Smith was held throughout the electrical profession in the Liverpool area.

MR. J. M. HENDERSON.—We regret to record the death, which occurred on November 20th at Aberdeen, after a very short illness, of Mr. John Macdonald Henderson, ex-M.P. for Aberdeenshire West (1906 to 1918). Mr. Henderson, who was a chartered accountant and was called to the Bar, was a director of various electrical companies, including Ferranti, Ltd., the South Lancashire Tramways Co., and the Lancashire United Tramways Co. He was 78 years of age.

MR. J. B. HUMPHREYS.—We regret to record the death, as a result of being knocked down by a motor car, of Mr. J. B. Humphreys, director and manager of Ferguson Superheaters, Ltd., of Kingsway, W.C. 2, with whom he had been associated for many years. At the inquest, the Coroner made some strong comments upon the danger of dazzling headlights, which were the cause of this fatality.

MR. F. WORLDEY.—The death is announced, at the age of 72 years, of Mr. Frederick Worldey, who was for many years in business as an electrical engineer in Norman Road and Shepherd Street, St. Leonards, Hastings.

Wills.—The late MR. W. C. KELLY, a director of the Barbados Electric Supply Co., Ltd., left £14,119.

The late Sir R. V. VASSAR-SMITH, the well-known banker, left £51,091 gross and £37,808 net personalty.

NEW COMPANIES REGISTERED.

Thames Valley Electric Supply Co. (185,597).—Registered on November 8th with a nominal capital of £100 in £1 shares. To carry on in Henley-on-Thames, Shiplake, Wargrave, Twyford, Sonning, and in other places in the rural districts of Henley and Wokingham, and in the counties of Berkshire, Buckingham, and Oxford and elsewhere the business of an electric supply company. The subscribers (each with one share) are:—W. May, 18, Austin Friars, E.C.2, solicitor; G. W. Spencer Hawes, Market Place, Reading, consulting electrical engineer; C. E. Hewett, Station Road, Reading, solicitor; J. May, 26, Victoria Street, Westminster, civil engineer; W. Pole South, "Readlands," Reading, civil engineer; P. Dawson, St. Stephen's House, Westminster, S.W.1; Col. J. E. Broadbent, "Fynesbury," Reading. Registered without articles of association. No persons had consented to act as directors to November 7th. Solicitors: Slaughter & May, 18, Austin Friars, E.C.

Weldrics (1922), Ltd. (185,661).—Private company. Registered November 10th. Capital, £25,000 in £1 shares. To acquire the business of manufacturers of electrodes, electric welding appliances, &c., carried on at Inverness, as "Weldrics, Ltd.," to acquire the process for the manufacture of the "Corundel" abrasive wheel, the registered trade mark of which is 28,665.1 in class 50, and to adopt agreements (1) with Weldrics, Ltd., and R. R. Callingham, the liquidator thereof, and (2) with W. H. Boorne. The first directors are:—A. W. Bullivant, 72, Mark Lane, E.C.; W. H. Boorne (managing director and technical adviser), A.M.I.M.E., M.S.C.I., Bush Lane House, Cannon Street, E.C.; D. C. Bouser, "Overdale," Dunblane, N.B.; T. H. Williamson, 9, York Place, Edinburgh; E. Chalmers, 9, Polwarth Terrace, Edinburgh. Qualification: £500. Secretary: N. B. Young. Registered office: Bush Lane House, Cannon Street, E.C.

Roberts Bros. (Engineers), Ltd. (185,656).—Private company. Registered November 10th. Capital, £1,500 in £1 shares. To acquire the business of electrical engineers carried on by Roberts Bros. & Holloway, Ltd. (in liquidation), at Bradford. The subscribers (each with one share) are:—A. Roberts, Cragg Cottage, Rawdon, electrical engineer; Mrs. M. A. Roberts, Cragg Cottage, Rawdon. A. Roberts is permanent governing director. Qualification: £1. Registered office: 3, Nutter Place, North Parade, Bradford.

West Kilbride Electric and Lighting Co., Ltd. (12,431).—Registered in Edinburgh November 9th. Capital, £6,000 in £1 shares. To carry on in the parish of West Kilbride or elsewhere the business of electrical engineers, electricians, contractors, &c. Minimum cash subscription, £3,000. The first directors are:—J. Newbigging, Seamill Hydropathic, West Kilbride, hydro manager; R. Barr, "Whinhurst," Kilbride, shipowner; J. H. Gemmill, "Ashfield," Kilbride, master joiner; W. Gray, "Drummilling," Kilbride, solicitor and bank agent; H. H. A. Greer, "Netherby," Kilbride, metal merchant; R. Guy, Alton Cottage, Kilbride, master painter; W. E. Mackenzie, "Redcroft," Kilbride, solicitor; J. G. Penman, 37, Bath Street, Glasgow, electrical engineer; L. D. Penman, "Dunallan," West Kilbride, architect. Secretary: Wm. Gray. Registered office: 75, Main Street, West Kilbride.

L. W. Douthwaite & Co., Ltd. (185,649).—Private company. Registered November 10th. Capital, £7,000 in £1 shares. To adopt an agreement with L. W. Douthwaite, and to carry on the business of electrical accessories merchants, manufacturers of, and dealers in electrical accessories, switchboards, magnetos, bells, batteries, &c. The first directors are:—L. W. Douthwaite, 8, Bankfield Road, Shipley; T. Barnes, 29, Norwood Avenue, Shipley. Qualification: £100. Registered office: 28, St. John Street, Bradford.

Institution of Engineering Inspection (185,645).—(The word "limited" is omitted from the title by licence of the Board of Trade.) Registered on November 10th as a company limited by guarantee. The objects are: To take over the assets and liabilities of the Technical Inspection Association; to promote and encourage the practice of inspection in engineering and allied industries, &c. The management is vested in a Council, the following persons having consented to act thereon: N. P. P. Sandberg, 6, West Eaton Place, S.W., C.E., president (director of Sandberg Sorbitic Steel Co., Ltd.); Lt.-Col. P. R. Embury, Carlton House, Tunbridge Wells, engineer (European representative Bethlehem Steel Co., U.S.A.); F. R. Wade, 87, Campden Hill Court, Kensington, consulting engineer (director, C. A. Vandervell & Co., Ltd., and C. A. V. Small Tools, Ltd.); A. E. Hadley, High Clare, Claygate, Surrey, electrical engineer (director, Victoria Falls and Transvaal Power Co., Ltd.) (past president); H. Gutteridge, 17, Victoria Street, S.W.1, inspecting engineer; D. Leechman, 35, Lee Park, S.E.3, barrister. Secretary: C. L. Wharton. The registered office is at Palace Chambers, Westminster.

Birmingham Radio and Engineering Co., Ltd. (185,631).—Private company. Registered November 10th. Capital, £1,500 in £1 shares. To take over, as from August 15th, 1922, the business of electrical engineers carried on at Newhall Chambers, 8, Newhall Street, Birmingham, as "Wright and Co.," and to adopt an agreement with C. B. Richmond. The permanent directors are:—R. W. K. Ward, 52, Lyndon Road, Olton, engineer; C. B. Richmond, "Dovedale," Kineton Road, Olton, engineer. Registered office: 8, Newhall Street, Birmingham.

Holmes & James, Ltd. (185,742).—Private company. Registered November 15th. Capital, £1,000 in £1 shares. To acquire the business carried on at 27, Freeman Street, Birmingham, as "Holmes and James"; and to carry on the business of electrical, mechanical, motor and general engineers, manufacturers of electrical accessories, fittings and appliances, &c. The first directors are: H. E. Holmes, 64, Stoney Stanton Road, Coventry, electrical engineer; H. W. James, 52, Crompton Road, Handsworth, Birmingham, electrical engineer; S. J. J. Vaughton, 29, Mary Road, Stechford, Birmingham, electrical engineer; A. W. Boston, 38, Handsworth Wood Road, Birmingham, C.A. (all permanent, subject in the case of the first three named to holding £150 shares, and in the case of the last named to holding £150 debentures). Qualification: 150 shares. Solicitors: Freeland and Passey, 71, Temple Row, Birmingham.

London Electric Stores, Ltd. (185,651).—Private company. Registered November 10th. Capital, £1,000 in £1 shares. To acquire the business carried on by W. A. Hunt, G. V. Ormsby and A. A. Byne, as the "London Electric Stores." The first directors are: W. A. Hunt, 4, Courtfield Gardens, Ealing, W.; G. V. Ormsby, 3, Brookwood Road, Southfields, S.W.; A. A. Byne, 8, Kingsley Street, Lavender Hill, S.W. Qualification: £250. Remuneration as fixed by the company. Registered office: 23a, Oxenden Street, Haymarket, S.W.1.

Lamp Caps, Ltd. (186,691).—Registered as a private company on November 13th, with a nominal capital of £50,000 in £1 shares. The objects are: To carry on the business of manufacturers and sellers of and dealers in caps for electric lamps and other articles, instruments, apparatus used for, or in connection with electric lamps, electrical and general engineers, &c. The first directors are: H. N. Sporborg, 42, Hillmarton Road, Rugby, chief engineer British Thomson-Houston Co., Ltd., and W. T. Munro, 25, Elsee Road, Rugby, chief of production lamps department, British Thomson-Houston Co., Ltd. (nominees of British Thomson-Houston Co., Ltd.); J. Y. Fletcher, Wapshott, Chertsey, near Staines, director General Electric Co., Ltd., and C. Wilson, 80, Castlenau, Barnes, S.W., director General Electric Co., Ltd. (nominees of General Electric Co., Ltd.). The above-named companies have each the right to appoint two directors while respectively holding a third of the issued shares. So long as the said companies are entitled to nominate directors, they may alternately appoint a director in each year, the first being appointed by the General Electric Co. Remuneration (except managing director) as fixed by the company. The registered office is at Magnet House, Kingsway, W.C.2.

Mirror Silvering Patents Development, Ltd. (185,720).—Registered November 14th. Private company. Capital, £1,000 in 975 shares of £1 each and 500 founders' shares of 1s. each. To acquire the business of a mirror silverer, experimental laboratory proprietor, patentee, and owner of British and foreign patents in connection with "The Barnes Process" for silvering searchlight and other mirrors, electrical and general engineer, &c., carried on by A. M. Barnes at 118a, Holdenhurst Road, Bournemouth, as the "Mirror Silvering Patents Co." The permanent directors are: A. M. Barnes, Teinton Wood House, Grove Road, Bournemouth, electrical engineer; T. A. W. Other, 200, Old Christchurch Road, Bournemouth, solicitor. Registered office: 200, Old Christchurch Road, Bournemouth.

Richards Hardware, Ltd. (185,785).—Registered November 16th. Capital, £10,000 in £5 shares. To take over the business of a hardware factor and manufacturers' agent carried on by F. D. C. Richards at 2,, Montpellier, Gloucester, as "Frank D. C. Richards." The first directors are: F. D. C. Richards, 2, Montpellier, Gloucester, hardware factor (managing and permanent director); V. H. Parsons, 36, Eastgate Street, Gloucester, ironmonger; J. C. Baker, 48, Foregate Street, Worcester, ironmonger. Minimum cash subscription, £35. No share shall be allotted or transferred to any person or corporation unless they are actively engaged in the ironmongery and electrical trades in Great Britain. Qualification: £300. Remuneration of managing director, £600 per annum. Secretary: E. Cope. Registered office: 2, Montpellier, Gloucester.

Health Machines, Ltd. (185,741).—Registered November 15th. Capital, £2,000 in 1,500 preference shares of £1 each and 10,000 ordinary shares of 1s. each. To carry on the business of electrical engineers, manufacturers of electrical apparatus and materials, manufacturing chemists and druggists, drysalters, &c. The first directors are: R. L. Urquhart, Tavistock Hotel, Covent Garden, W.; T. C. Hodgkinson, 35, Westcroft Square, W.C. Minimum cash subscription, 7 ordinary shares. Qualification: 100 shares. Remuneration (except managing director): £150 each per annum (chairman, £200). Registered office: 35, Westcroft Square, Hammersmith, W.

H. Maguire, Ltd. (185,714).—Private company. Registered November 14th. Capital, £1,000 in £1 shares. To take over the business of an electrical engineer carried on by H. Maguire, at 6, Witham, Hull, as "H. Maguire & Co." The first directors are: H. Maguire, 6, Witham, Hull; A. Gilboy, 346, Holderness Road, Hull, permanent director and chairman (director, Annisons, Ltd.). Registered office: 6, Witham, Hull.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cesco, Ltd.—E. Thomas, of Baltic House, Mount Stuart Square, Cardiff, appointed receiver November 9th, under powers contained in debenture dated March 2nd, 1922.

Hindhead and District Electric Light Co., Ltd.—Issue on November 7th, 1922, of £150 debentures, part of a series already registered.

China and Japan Telephone and Electric Co., Ltd.—Particulars filed of £50,000 debentures authorised by resolutions of November 28th, 1905, and October 24th, 1922, charged on the company's undertaking, property and other assets, present and future, the amount of the present issue being £37,500.

Super Welding Co., Ltd.—Debenture dated November 7th, 1922, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. S. Hughes, 10, Croston Street, Beswick, Manchester.

Carmarthen Electric Supply Co., Ltd.—Mortgage dated March 26th, 1921, to secure £1,000, charged on 8, St. David's Avenue, Carmarthen. Holder: G. Griffiths, Llain, Carmarthen. (Registered November 6th, 1922, pursuant to Order of Court.)

Whitstable Electric Co., Ltd.—Particulars filed of £10,000 debentures authorised October 27th, 1922, and covered by trust deed of even date charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees: W. H. Reeves and A. Collar.

CITY NOTES.

Cape Electric Tramways, Ltd.

In their report for the year ended June 30th, 1922, the directors state that there was a profit of £80,703, and, after providing for debenture interest, redemption of debentures, and taking into account the balance brought forward, a net credit balance of £60,506 remains. £18,000 has been put to reserve, leaving £42,506. A dividend of 6 per cent., free of income tax, on the ordinary shares will absorb £29,473, leaving £13,033 to be carried forward. During the year the tramways carried 31,283,916 passengers, with gross receipts of £414,570, as against 29,773,587 passengers, with gross receipts of £397,124 in 1920-21. While receipts have advanced expenditure has more than correspondingly increased. This is due to the greater amount that has had to be provided on account of the arrears of maintenance, which should have been undertaken in the past, and were postponed owing to the conditions brought about by the war, the subsequent difficulty in obtaining supplies, and the labour troubles which afterwards developed. The whole of these arrears will be made good within the next two years.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

The directors' report for the year ended August 31st states that the accounts show, after making provision for doubtful debts, &c., a net loss of £94,406. The balance brought forward from last year was £35,498, less dividend on preference shares paid in January and July £12,500, leaving £22,998, to which is added £75,000 transferred from reserve fund, making £97,998. Less loss as above £94,406, leaving to be carried forward £3,592. "The directors regret the loss incurred, which is due to two main causes, of which further depreciation in stock values is the chief one, and secondly, to conditions surrounding the tire section of the business brought about by intense foreign competition. To cover the loss on the year's work, the directors have withdrawn £75,000 from the reserve fund, leaving £140,722 to the credit of that fund and £3,592 to be carried forward. The board regrets that the payment of a dividend on the ordinary shares is impossible, but with a return to more normal conditions it feels confident that the company will once more be put on a dividend-paying basis. The warrants for the half-yearly dividend on the preference shares will be payable on January 1st, 1923. To the unanimous regret of the board, Major Darwin has resigned the chairmanship of the board of directors, as he desired to have leisure for other work not connected with business. The managing director, Mr. C. H. Gray, was unanimously elected to the chairmanship of the board of directors and Major Darwin to the deputy chairmanship." Meeting: November 30th, at 106, Cannon Street, London, E.C.

Western Telegraph Co., Ltd.—The revenue for the year ended June 30th, 1922, was £1,680,049 and the working expenses were £839,045. After providing £32,747 for debenture stock interest, and £260,709 for income tax, corporation profits tax, and final adjustment of excess profits duty, there remains £547,549, plus £128,739 brought forward. £250,000 has been transferred to the general reserve fund. Four dividends of 2½ per cent. each have been paid, amounting to £311,895, making a distribution of 10 per cent., free of income tax, for the year, thus leaving £114,392 to be carried forward. The company's cable steamer *Cormorant* struck some submerged wreckage and foundered off Rio Grande do Sul on January 24th, fortunately without loss of life. The Eastern Telegraph Co.'s C.S. *Sentinel* has been chartered to replace temporarily the lost ship.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Agricultural and General Engineers.—14 ordinary shares of £1 each, fully paid, Nos. 2,485,619 to 2,485,632; and 240,000 new 6 per cent. second preference shares of £1 each, fully paid, Nos. 28,321 to 268,320.

Fellows Magneto Co.—723 ordinary shares of 10s. each, fully paid, Nos. 252,892 to 253,614.

North Wales Power and Traction Co.—The accounts for 1921 show a profit of £14,315. £12,992 is deducted for interest on debentures and £250 for interest on loans, leaving a balance of £1,073. £659 is brought forward, making the total credit balance £1,732.

Siemens Bros. & Co., Ltd.—The directors announce that they are unable to make any interim distribution on the ordinary shares. A year ago an interim dividend of 5 per cent., free of tax, was paid.

British Electric Traction Co., Ltd.—The directors have declared interim dividends of 3 per cent. on the 6 per cent. cumulative participating preference stock and of 2 per cent. on the ordinary stock on account of the year ending March 31st, 1923.

Ever Ready Co. (Great Britain), Ltd.—Interim dividend at the rate of 7 per cent. per annum on both the preference and the ordinary shares.

Chloride Electrical Storage Co., Ltd.—Interim dividend of 5 per cent., free of tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

THE after-effect of the result of the General Election has been a little disappointing to most of the Stock Exchange markets, which had been looking for a revival in general business upon the return of a sufficiently large Conservative majority to enable Mr. Bonar Law to proceed with his policy. People not only in the Stock Exchange, but evidently throughout the country, had hoped that this would re-energise business, and impart a greater air of activity to the markets. Whereas what actually happened was that the activity of an hour or two became succeeded by quietude, which in its turn has been followed by a certain amount of profit-taking on the part of those who had bought stock in advance of the Election, and who have been turning it out at small profits. Various minor matters have contributed to the lack of new buying orders. In the electrical markets, the passing of the dividend on Siemens ordinary shares and the presentation of a report, from the India Rubber Co. showing a loss of £94,000 for the year, have brought about falls, of course, in the shares of both companies.

As the second six months of 1922 draws to its close, it is becoming appreciated by a widening circle that the electricity supply companies have done exceedingly well, and that there is a very fair possibility of dividends showing an almost unanimous increase. In fact, from some of the talk in the market, it might be supposed that the companies are enjoying such a bumper year as would induce directors to distribute dividends which prudence might deem as indiscreet, considering the necessity that there still exists for the companies to establish themselves in impregnable financial positions. It is scarcely to be expected that 1923 will prove such a pleasant one for the companies as is the case with the current year. From this, it is not to be inferred that shareholders are advised to get out of their holdings at the present quotations, which, after all, are not over-valued. It is worth pointing out, however, that over-optimistic dividend anticipations receive no encouragement from those who are in the best position to know what is likely to happen. The market naturally keeps very firm, and the amount of floating supply diminishes week by week.

The Brompton & Kensington Electricity Supply Co. has sent notices to the holders of its preference shares, pointing out that proprietors have the option at any time of giving one month's notice to exchange each preference share for one ordinary share of the company. The Brompton directors intend to issue a notice shortly to the shareholders, inviting them to pass certain resolutions for the purpose of capitalising the reserve fund and part of the depreciation fund. After this, they propose to distribute a bonus of one new ordinary fully-paid share for each two ordinary shares now held by the shareholders. Preference shareholders have been given the opportunity for converting their shares into the ordinary before the necessary meetings take place, in order that they, the preference shareholders, should be able to participate in the bonus to be distributed to the ordinary. The last day for doing this was Thursday in this week, but if any preference shareholders have neglected to send in their certificate and consent, they should do so immediately, when it is possible that their application will be entertained.

St. James, South London, and London preference have each risen ¼. Kensingtons at 7¾ are 5s. up. Bromptons fell a similar amount to 9, the effect of the announcement of new shares evidently having been discounted in advance; the loss, however, was promptly regained. Amongst manufacturing shares, British Insulated are 9d. lower at 43s. 9d. India Rubber shares fell 2s. to 12s. 6d., on the issue of a report showing a deficit on the profit and loss account of £94,400. Last year it may be remembered the loss was £140,000 for eleven months, so present figures can be regarded as better. Siemens dropped to 21s. 3d., a fall of 4s. 6d. on the passing of the dividend, which a year ago was 5 per cent., free of tax. The announcement was not entirely unexpected, though few people had thought that the company would pass the dividend entirely. That the distribution might be cut was almost generally expected; indeed, it has been frequently hinted in these columns. The passing of the dividend altogether is a considerable disappointment. The company's preference fell to 28s. 9d., and the debentures lost a point at 88. Other manufacturing shares are tolerably steady. Edisons are 6d. down at 2s. 6d. Metropolitan-Vickers preference at 2⅛ are 1/16 lower, but the ordinary strengthened to 25s. 9d. No changes occurred in General Electrics. Edmundsons are harder at 36s. 3d. for the ordinary and 4¼ for the preference.

Home Railway stocks are better, with Metropolitans 4½ up at 60, and Districts a couple of points higher at 43¼. Underground Electric ordinary rose 3½, and the income bonds to 87½. The tube companies are about to embark upon a very ambitious programme of extension, the reason for which is made obvious by the supposition that the company will expect to receive a Government guarantee for its new issues, in the same way as it has done lately in respect of the various 4½ per cent. debentures offered within the past few months. The Government is anxious for work to be provided for the unemployed, and therefore is giving favourable consideration to schemes of railway construction that will employ large numbers of men. The railway companies see their way to getting capital at a modest rate, and so both sides are suited. The 4½ per cent. Tube debentures stand at "par," the fully-paid being 93 in each case, but the supply of stock is becoming very limited.

Marconi debentures have risen to 3½ premium. The shares show no change at 2 5/16. Canadian Marconi firmed up to 10s. Cable stocks are still heavy as a whole. Cuba Submarines, on the other hand, are 2s. 6d. higher at 7⅞. The Eastern group shows practically no recovery from the dull prices which prevailed this time last week.

British Electric Traction improved a trifle to 62½ on the declaration of an interim dividend of 2 per cent. actual. This is the first interim since the company became reconstructed. For last year, the full dividend was 4½ per cent., and the optimists hope for 6 per cent. in respect of the current twelve months. The feature in this section is the remarkable advance in British Columbia Electric stocks, the deferred gaining 5 and the preferred 7½ points. It is said that the company has received permission to retain, for another three years, the right to charge six cents for fares that used to be five cents, but so far as is known in the market, no official confirmation of this has come in. Readers of the REVIEW who have taken practical interest in the stocks may well feel gratified in the way in which the prices have risen this year. Brazilian issues are all better, also, for which the reason is a sharp rise in the value of the milreis. Mexicans are fairly firm. Calcutta Tramways ordinary at 4¼ show a small decline.

The rubber share market is steady, but idle. Iron and steel shares weakened a little on the passing of the final dividend by the Dorman Long Co. Armaments attract no particular interest.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Nov. 21. 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	9¼	—	£6 9 9
Charing Cross Ordinary	8	9	7⅞	—	5 16 2
do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	+ ⅛	4 12 4
City of London	14	14	2⅛	—	6 15 7
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1¼	—	5 4 4
Kensington Ordinary	9	10	7¾	+ ¼	6 9 0
London Electric	3½	4	3⅛	—	3 17 6
do. do. 6 per cent. Pref.	6	6	5¼	+ ⅛	5 17 1
Metropolitan	7	7	6½	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9¼	+ ¼	6 9 9
South London	7	7	4⅞	+ ¼	6 7 10
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7¾	—	6 9 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	102	—	5 17 6
do. Def.	1½	84/6	22½	—	6 9 6
Chile Telephone	6	6	6⅞	—	4 16 0
Cuba Sub. Ord.	7	7	7¼	+ ⅛	8 17 10
Eastern Extension	10	10	19½	—	5 4 0
Eastern Tel. Ord.	10	10	190	—	5 5 8
Globe Tel. and T. Ord.	10	10	19½	—	5 4 0
do. do. Pref.	6	6	113	—	5 5 0
Great Northern Tel.	24	22	98	—	7 17 2
Indo-European	10	10	85½	—	7 1 0
Marconi	25	15	2⅞	—	6 9 6
Oriental Telephone Ord.	12	12	2⅞	—	*5 4 0
United R. Plate Tel.	8	8	7⅛	—	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 3
HOME RAILS.					
Central London Ord. Assented	4	4	77	—	5 19 5
Metropolitan	1½	2½	60	+4½	3 15 0
do District	Nil	1	43¼	+2	2 6 3
Underground Electric Ordinary	Nil	Nil	9⅛	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	+1	*4 11 5
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8⅝	—	7 11 9
do. do. 2nd Pref.	Nil	6¼	3⅛	—	7 2 0
do. do. 5 per cent. Deb.	5	5	85½	+1¼	5 17 0
Brazil Tractions	Nil	Nil	50½	+4½	7 16 6
British Columbia Elec. Rly. Pcs.	5	5	80	+2½	6 5 0
do. do. Preferred	5	92/-	75½	+7½	*6 4 6
do. do. Deferred	8	124/-	89½	+5	*7 12 6
do. do. Deb.	4½	4½	76	—	5 11 10
Mexico Trams. 5 per cent. Bonds	Nil	Nil	78	—	6 11 7
do. do. 6 per cent. Bonds	Nil	Nil	47	+ ½	Nil
Mexican Light Common	Nil	Nil	21½	+1	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds	Nil	6	85½	—	7 14 6
MANUFACTURING COMPANIES					
Babcock & Wilcox	15	16	8¼	—	4 18 6
British Aluminium Ord.	10	5	16/9	—	5 19 5
British Insulated Ord.	15	15	2⅞	—9d.	6 17 0
Callenders	15	15	2⅞	—	6 17 0
6½ Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 18 4
Edison-Swan	10	Nil	2/6	—6d.	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1 7/32xd	+6d.	7 12 4
English Electric	8	5	15/0	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 8 0
Gen. Elec. Pref.	6¼	6¼	21/9	—	5 19 6
do. Ord.	10	5	17/6	—	5 14 3
Henley	15	15	2 5/32	+ 5/32	6 11 3
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	12/6	—2/-	—
Met.-Vickers Pref.	8	8	2⅛	— 1/16	6 14 9
Siemens Ord.	10	10	1⅛	—4/6	—
Telegraph Con.	20	20	26½	—	*4 13 6

* Dividends paid free of Income Tax.

SOME USEFUL ADJUNCTS IN METER AND INSTRUMENT WORK.

By G. E. MOORE.

Introductory: Concerning Practical "Tips."

In these days of specialisation, of automatic machinery, of mass production, the saying, "Every job its tool," might well be a truism. I do not wish to dwell upon the general aspect of this, but rather to draw attention to the personal factor when this is characterised by

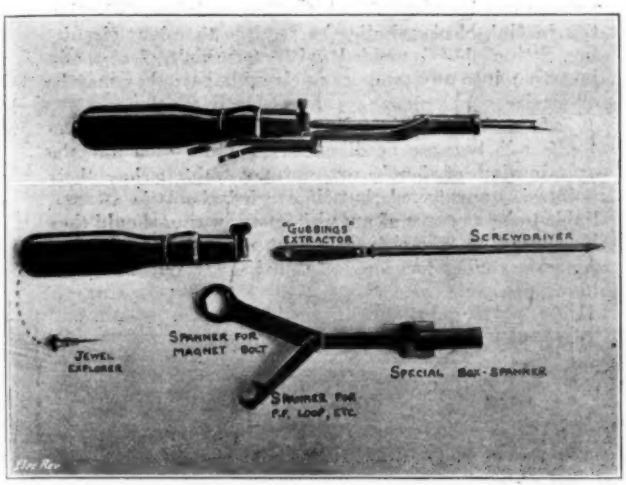


Fig. 1.—A Combination Tool.

"gumption." As one settles down in a particular sphere of activity, and the first suspicions and doubts give place to a deeper and more tolerant understanding, one begins to indulge in more or less practical criticism of the methods and means in vogue. This criticism may or may not represent an advance, and it is possible that any practical development will not meet with general favour; the point is that the personal factor is operating, and, operating, will inevitably at some time or other be the agent of real progress.

The personal factor, with its discernment and its modifying effects, forms quite a study. Trial and error, the instructive incidents of experience, a practical trait coupled with the precious knack of improvisation (of which I have dealt elsewhere in these pages) are all involved. Now, quite a lot of work-a-day knowledge is the outcome, and it seems to me a pity that such knowledge should ever remain parochial, so to speak; but here in Britain, owing not to a habit of secrecy so much as reticence, it does not appear to be "the thing" to pass on the useful little "tips" of practical life—at any rate in a broadcast way. I think that the mechanical side of engineering is luckier than ours in this respect, while the youthful amateurs and the formidable new army of wireless recruits are the best off of all! And one may add that, speaking generally, there is a marked reluctance in the British technical Press to reproduce the useful (and sometimes diverting) ideas published abroad.

In the U.S.A. there is, I think, a considerably more open and encouraging attitude towards the dissemination of practical hints, and although there is an element of slightly irritating publicity about some of it, I cannot conceive of aught but good resulting from such policy. The Electrical Review has on occasion invited practical articles, frankly hinting that writers need not hesitate because they doubt their own skill *as writers;* but this inducement has hardly been responded to as fully as it might have been.

Of course, owing to the fact that the personal factor discriminates, a practical hint is never acceptable to everybody. But it does not always fall upon stony ground of that nature. With this prevision, and a fervent hope that the preamble has not set up too critical a flux, I propose leaving this homily in favour of some little "gadgets" and the like which I have found useful. Their nature is indicated by the title, and they may be broadly, as well as specifically, useful. I have not had the temerity to label them "novel" because, although they are my own, I do not want someone to write up next week saying that *he* thought of so-and-so—oh, quite twenty years ago!

A Combination Tool.—This curious-looking appliance (fig. 1), the components of which provide all the separate tools required for routine adjustments, &c., of Metropolitan-Vickers a.c. meters, took a few months to evolve. I think it would be interesting to explain its genesis. As in many types of meters, the jewel-fitting which receives the bottom pivot of the disk movement consists of a brass screw (inset with a jewel) passing through a short bracket and locked thereunder by a nut. The removal or adjustment of such jewel-fitting is almost always troublesome, mainly because one cannot ensure the screw and nut not affecting each other, and because replacement of the fitting is irksome. Such routine operations as these are usually carried out by means of a screwdriver and a box-spanner. It occurred to the writer that, by passing the screwdriver shaft through an axial hole in the box-spanner, it would be possible to have both tools in place at once.

After several forms had been made and scrapped (the first one was a puny affair two inches long), that shown in the first illustration was arrived at. A short length of silver steel was bored for the screwdriver shaft; at one end a larger hole was sunk, and the rod, whilst red-

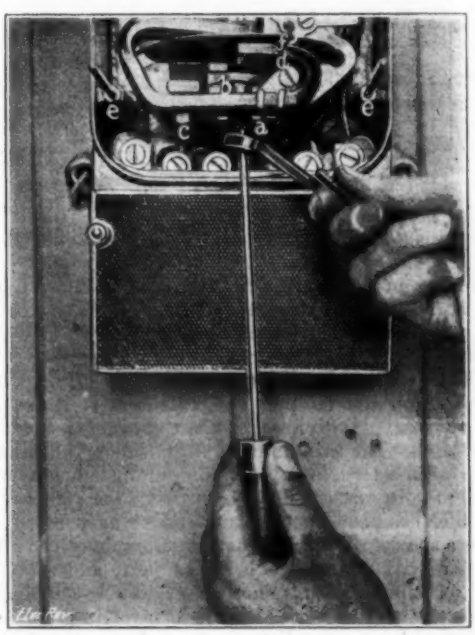


Fig. 2.—Screwdriver-spanner Device in Use.

hot, was then forced at this end over a correctly-sized steel nut; a swivel handle was prepared, and the tool tempered.

In fig. 2 this screwdriver-spanner device is seen in use. At *b* is the bracket through which the jewel-stem is screwed, and the box-spanner *a* is there seen embracing the locking-nut. With this arrangement it is possible to slacken the locking-nut, adjust the jewel (and therefore disk movement) up or down, and then re-lock

without jeopardising the new adjustment; to remove the whole intact without dropping it; and to replace same easily by pressing the nut into the spanner, raising to the bracket and screwing home the threaded stem. The top pivotal arrangement (not shown) similar as regards the lock-nut, but not so susceptible to adjustment, can also be dealt with.

The next modification was the attachment of two other spanners to the swivel handle—these had always tended to be mislaid. Having proceeded thus far with the composite arrangement, it was really inevitable that the screwdriver should be altered, as shown, to include a needle for exploring the surface of jewels, and also a "gubbings" extractor ("gubbings" being a local term for the filings, &c., which sometimes appear on the poles of meter elements and braking magnets).*

The uses of the combination tool may be summarised as follows, fig. 2 being kept in view:—

(1) Facility in adjustment of jewel-fitting *b* (and upper pivotal device) by special box-spanner.

(2) Nut *e* on each stem supporting meter cover gripped by sliding the special box-spanner down stem.

(3) Fixing-bolt *c* of magnet held by larger spanner.

(4) Locking-nut on clamping screw *d* (which varies magnet position), and retaining nuts of compensating turns on pressure poles, taken by smaller spanner.

(5) Removal of filings, &c., from all poles by means of knife-like form of "'gubbings' extractor."

(6) Use of screwdriver for jewel-stem, screw-head *d*, friction-compensator screw *f*, balance adjusters (in polyphase meters), dial screws, &c.; and

(7) Jewels examined by "jewel explorer."

Occasionally weightier tools are required, but for the average job and the particular make of meter it serves its purpose. Individually, the components are useful elsewhere. The combination tool shows what can be done when a large number of similar instruments or the like are in use; taken by itself, the screwdriver-spanner component may be found to have much more than a special application as heretofore described; while the screwdriver with the modified shaft and fitted with a jewel explorer forms another serviceable combination.

Handy "Link-Blocks."—Tests involving the use of instruments at some distance from the source of supply necessitate long leads, and at times (notably during generator trials with the machine on load and the leads connected to the current transformer secondaries) it is required to make a meter or instrument change without, of course, breaking the (secondary) circuit. This has been done either by a shorting wire at the terminals or by cross-connecting or twisting together bared portions of the leads. Such arrangement being rather crude, the writer fitted a link-block device as shown in fig. 3A. The two leads run through a fibre block, the wire being bare inside the latter (refer to dotted lines) and gripped there by two screws; the projecting stems are fitted with nuts and a brass link, a wire ring at the top of each stem making it impossible for the nuts to drop off. The block can be suitably marked—that in the illustration, for instance, signifying that the leads in question are *blue* phase, one dot *incoming*, two dots *outgoing*.

This arrangement takes up little room, was cheap and readily made, is effective, and robust enough for the somewhat rough usage. In this particular case the potential reaches only a few volts, and there is hardly need for covering insulation beyond, occasionally, a few turns of tape. But, if required, a suitably-insulated pattern can be adopted. A further useful modification lies in link-blocks similar as regards the short-circuiting fitting, but provided with terminals for ready insertion into any temporary circuit where they may be of service.

Safety Holders for Needles.—I bring in the term "safety" because needles and the like used for the examination of jewels are apt not only to lose their points if unprotected, but, if carried about the person, liable to be a source of anguish—nay, worse, should they be housed in a waistcoat-pocket near the duodenum! A pocket scriber forms a useful makeshift, but the writer favours ready-made points, and fig. 3B shows two "disappearing pencils" adapted for use in this respect.

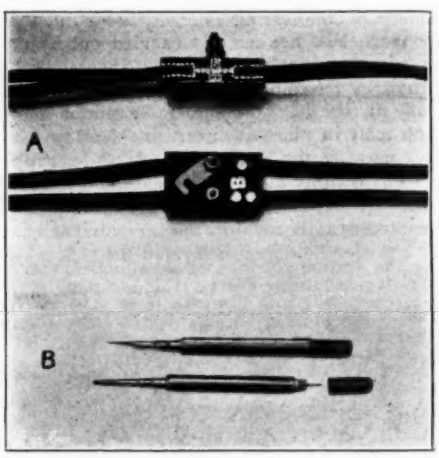


Fig. 3.—Link-blocks and Pencils.

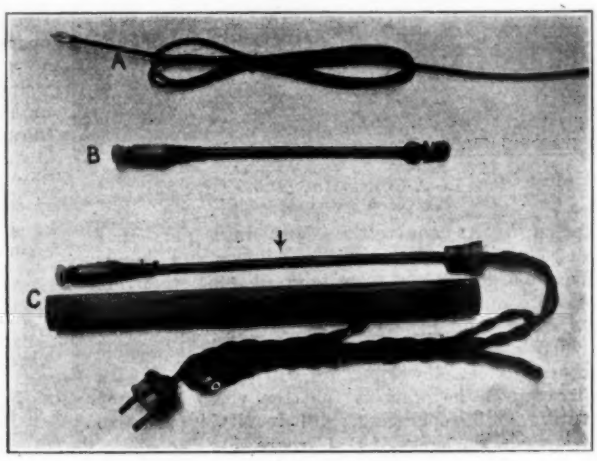


Fig. 4.—Inspectional Devices.

In the upper one the pencil itself has been replaced by a gramophone needle, a spare one being kept in the covered recess at the other end of the holder; rotation of the holder causes the needle to vanish inside it. The lower example in the figure shows the pencil retained and a needle mounted at the recessed end—a rather useful combination. The safety needle-holder has incidentally been useful in other ways—*e.g.*, pricking positions on charts, thermo-couple curves, &c. (The pencil-holders shown cost sixpence each, and are quite serviceable, but much more elaborate and costly ones, equally suitable for modifying, may be bought. No doubt these will appeal to the enthusiastic tyro and to the wealthy members of the fraternity!)

Miniature Inspection Lamps.—No matter how strong or diffused the light, or how deft one's arrangement of mirrors, one often cannot see into or illuminate just where one desires. Fig. 4 illustrates some forms of inspectional devices which are flexible and carry tiny lamps. Type A was mainly designed for a variety of instruments, and consists of a long length of sleeving carrying flexible wires running to a small pea-lamp. Type B is much more robust, can be packed away in one's tool-bag, and is intended to be screwed into a pocket-lamp case; to the screw for the latter operation is attached a short length of Bowden-wire tubing,

* Elec. Rev., April 14th, 1922, p. 531.

through which run the flexible wires to the miniature lamp fitting at the other end. Type C is a test-bench modification of the latter, the Bowden tubing (shown by arrow) being somewhat longer and attached to a two-yard length of twin flex, terminating in a miniature two-pin plug; when not in use the lamp is stowed away in a thermometer case (shown) and retained by a stopper.

Types B and C were primarily intended for the internal examination of meters; for the measurement of tooth-depthing and the showing-up of a filing on a pole (a filing here has been known to have a ratchet effect upon the disk), such inspectional lamps are very useful. With ordinary care they are found robust enough, the limit of breakage being decided not by the glass bulb, but by the filament. Due regard must be paid to the voltage (the usual 3-4 V); maximum illumination is not always desirable, and a ½ to 1-V drop in the leads or a resistance is a happy arrangement.

Removing Dust, &c.—The removal of dust and the like is often a matter of grave concern. Two improvised ejectors have proved useful. The first one involves the use of an ordinary bicycle pump. In addition to the probing quality of the flexible connector, there is the advantage of a concentrated blast of air of considerable force. And it is *dry*. The efficacy of the bicycle pump in this respect was first shown on kinematographic machinery, one interesting example being in the removal of odd particles of dirt from the gate of a projector; whilst a film, especially an uncleaned old one, is being screened, particles collect in the "mask" and are thrown on the screen in magnified form, but in an open type of projector a fierce puff from a bicycle pump generally dislodges the substance without interfering with the "picture" in any way.

The second of my two expedients was discovered in a laboratory where some electrical exhibits were on view; a sudden demand arose for a steady current of air which must needs be dry or at any rate warm. An electric hair dryer of the form shown in fig. 5 (electro by courtesy of the G.E.C.) was one of the said exhibits; this was borrowed and provided a blast of air of moderate force—hot or cold at will. An additional advantage with this apparatus is that it can be held steady with one hand and the current of air directed with accuracy:

Fig. 5.—Electric Hair Dryer.

a difficult operation when (as in the case of the bicycle pump or similar source of air) both hands are in use. The electric hair dryer has been found particularly useful with statical instruments, &c., under laboratory conditions, for here, while general drying-out is often difficult to obtain or retain, there are instances where a temporary local effect suffices; this is given by the hair dryer, with the heater turned on.

Such apparatus would be more useful still if a stronger air current were available, with, possibly, a variety of nozzles—one at least similar to the flexible connector of a bicycle pump.

THE DEVELOPMENT OF ELECTRICAL ENGINEERING IN THE FAR EAST

By C. A. MIDDLETON SMITH, M.Sc., &c. (Taikoo Professor of Engineering and Director of the Engineering Laboratories and Workshops in the University of Hongkong).

(*Concluded from p.* 698.)

The Great Struggle.—It is, of course, impossible for the reader who has never been east of Suez to realise the amazing variety of peoples and the remarkable conditions of life in the Far East. This British port of Hongkong is the distributing centre for goods which go to nearly all Far Eastern ports, including those in the chain of islands to the south—Borneo, Java, Sumatra, &c. These tropical areas are being developed by the white man and the ubiquitous Chinese. It would be difficult to calculate the millions of tons of oil that have been exported from those islands, but the activities of the Asiatic Petroleum Co. are greatly in evidence all over China. In the development of the vast oil fields of the islands to the South of Hongkong much machinery has been used. They are aware of the value of the hydro-electric schemes that have stimulated industry. Factories for utilising native products are springing up. The mineral and agricultural wealth of those wonderful islands is being developed for the benefit of all humanity. In that development the industrious and persevering Chinese is playing a most important part.

Adjacent is the Malay Peninsula, with its tin and its tropical vegetation. Just now it is depressed, because of the rubber slump, but there is still British enterprise and the persevering Chinese. During the last few years a most successful coal mine has been opened, and there is a great project for a water-power scheme for a general supply of electrical energy. If we suggest that the Federated Malay States is, just now, less flourishing than four or five years ago, we must also state quite emphatically that the engineer has absolutely transformed it, and that parts of it have been made most productive. Electric power, the railways, and the splendid port facilities at Singapore, are but the beginnings of what must come in the near future; already great areas of the jungle have been made fertile, and much capital has been profitably invested in British machinery.

Its near neighbour, Siam, is also changing. Last week one of our Hongkong engineering Chinese graduates, at work in Siam, called to see his old teachers. He told us, with justifiable pride, how he had been helpful in replacing man-power by machinery. In that country the Chinese are the men of commerce, and at last it has dawned upon the minds of these men that machinery multiplies profits.

Coming northwards we have signs of progress in French Indo-China. And then we come to that vast country called China. It stretches from the tropics to the far-away north, where in winter the snow lies deep; it contains about 400 millions of a race second to none in industry. It is a people becoming galvanised into industrial activity by European and Japanese engineers; it is a people essentially peaceful and good tempered, and it is a country that has been made poor by parasitic officials, but one that will be made wealthy by modern inventions and the practical common sense of its merchants and artisans.

Currency Difficulties.—China is cursed, not only by its parasitic officials, but by a complicated silver currency. It might be supposed that a silver dollar in China was of the same value whether in Canton, Hankow, Shanghai, Tientsin, or Hongkong. Unfortunately

that is not so. Hongkong dollars may be at a 5 or 10 per cent. premium or discount in Shanghai. The Shanghai dollars vary in value with the dollar in Tientsin, and all of these dollars vary daily as against gold. Before the war, for a few years, the Hongkong dollar fluctuated from about 1s. 10d. to 2s. 1d. The war sent it down to below 1s. 8d., and then began the amazing rise which, early in 1920, reached the figure of 6s. 2d. Now it is about 2s. 6d. The currency unit for the Maritime Customs is the tael, a weight of silver of specific fineness. The value of the tael varies in almost every town. Decidedly one must have some experience of Chinese currency, or have agents who understand it, to do business in China. Speaking roughly, it is reckoned that the Customs tael is usually about 40 per cent. in excess of value of the Hongkong dollar.

The Customs returns for the last ten years have shown a steady increase in the import of machinery. The Statistical Secretary, in a recent report, says:—"The demand for all kinds of machinery, machine tools, and engineering goods is steadily growing, and inquiries are more and more received from remote places in the interior." Concerning electrical equipment, this report is most optimistic, as the following quotation will show:—"'Electrical Materials' is another interesting and suggestive heading. The demand for electric lighting in most cities altogether exceeded the supply, and existing plants were heavily overloaded, with the result that influential merchants and shopkeepers in the various cities purchased small electric lighting sets for the lighting of their own shops and perhaps two or three adjacent premises. These small sets were supplied almost entirely from America. There is a tendency in the more important establishments to install larger units, and while a few years ago 200- and 400-kW sets were considered large, it is now quite common to install units of 1,000 kW and upwards, and it is reported that a large number of orders had been placed for privately-owned power stations for the purpose of supplying power to cotton and flour mills. This increase in the amount of machinery installed has, of course, stimulated the demand for electrical accessories, fittings, and lamps. Japan has captured the lion's share of the business in accessories, especially in the cheaper kinds; America has the largest share of the better-class fittings and glassware; while in lamps the market is practically monopolised by the large factories in Shanghai and by Dutch and Japanese manufacturers. The importation of electrical materials into China amounted to 2.3 million taels in 1913, five millions in 1919, and 6.3 millions in 1920."

Readers of this journal are acquainted with the remarkable growth of the Shanghai municipal electrical undertaking. There are only three or four stations in Great Britain with a bigger capacity. Since 1919 the Hongkong Electric Co., Ltd., has placed orders for three sets of 5,000 kW each. Shanghai is typical of what will happen in other places. It is the inevitable industrial transformation of China that will lead to an increasing demand for electrical machinery. The financial aspect of engineering contracts in China demands consideration, but the profits are there. In these changes it is believed that the engineering graduates of Hongkong University will play an important part. Their ability cannot be questioned, as their work has been referred to and praised by examiners in the University of London. Most encouraging has been the recent offers by British firms to take these Chinese graduates into their English works, at a living wage. They should receive just the right experience that will make them useful representatives in the Far East.

A Cycle of Cathay.—Fifty years have, indeed, brought great changes to the Far East. There were very few European engineers out here in 1872. Now there are thousands of well-trained European and native engineers at work. The most rapid change has been in Japan, but China is now most anxious to acquire a knowledge of machinery. Particularly does electrical engineering attract the young Chinese. If we try to picture the Far East of fifty years ago we find it impossible. Very few Chinese spoke English, very few Europeans spoke Chinese; it is improbable that a half-a-dozen Chinese, out of a nation numbering 400 millions, had ever heard of the idea of either mechanical or electrical power. Fifty years ago Hongkong was just emerging from the struggles of its precarious infancy. Not long ago we celebrated the jubilee of our most ancient engineering works—the Hongkong and Whampoa Dock Co. We are only 80 years old as a British Colony, but in that short span we have grown from a pirate's haunt to the biggest port in the world. In 50 years our population has increased ten times, our revenue in a much greater ratio.

Fifty years ago there was not in the whole of South China, outside of Hongkong, a vehicle with a wheel; and in Shanghai, so far as we can picture the place, the Chinese used wheels only for their weird-looking wheelbarrows, although some of the Europeans had imported carriages.

Fifty years ago, but for the life in the tiny outposts of Singapore, Hongkong, and Shanghai, and the stirrings in Japan, caused by the glimmerings from the foreigners' torch of science, the hundreds of millions of humans in the Far East were living life as it had been lived since the dawn of history; the routine of at least 45 centuries went on as the unchanging cycles of Cathay succeeded each other. And then the torch of science grew stronger and stronger and was brought nearer and nearer. Gradually, by reason of its brilliance and its invigorating rays, it has affected, however remotely, almost all of the inhabitants of Japan, China, Siam, and other countries in the Far East.

First Impressions.—A cycle of Cathay is 60 years—this national cycle was instituted B.C. 2637. If you glance over the records of the past you will find evidence of Chinese ingenuity and industry, but always you will find the tendency to isolation. That tendency has gone, so far as the individual is concerned. The native of the Far East is by no means content with his country as it is; he has definite desires to see the countries of the West, and especially to see the latest inventions and conveniences to be found in those countries. He wants to copy them. The peoples of the Far East have at last awakened to the knowledge that applied science will be of enormous benefit to them.

At first, on arrival, the Western engineer is greatly disappointed with the Far East. It seems incredible that in all of South China, outside of Hongkong, there is scarcely a road. Yet inland there is machinery that has been carried for miles on bamboo poles by coolies, or taken along the waterways by junks towed by fussy little steam launches or motor-boats. For the first years out here the engineer will be impatient. He is so anxious to accelerate progress. It is only when he has had experience and looks back over a period of, say, ten years that he realises that, for all his impatience and the still great contrast between East and West, there have been changes.

The New Japan.—The most amazing change, for rapidity unequalled in the history of the world, has been the change-over of Japan from an entirely agricultural to an industrial country. In that transformation the British engineer has played the most prominent part. The great pioneers were Ayrton, Perry, Ewing, Dyer, Milne, and the other British who taught the youth of Japan applied science. To-day Japan has enormous shipbuilding yards, thousands of factories, electric railways, and countless hydro-electric installations. Many millions of pounds' worth of British machinery has gone to Japan to help in the work of the new civilisation. A month ago it was announced that the English Electric Co., Ltd., had secured an order for electric railway plant for Japan exceeding £500,000 in value. Turbines and surveying and electrical instruments, and almost every product of British engineering factories are exported to Japan. The timid talk of Japanese industrial competition; the bold engineer adventurers are out in Japan

booking orders. For they know that trade is the life-blood of the modern world, and trade in engineering products is impossible with a country that is not developing its natural resources.

At the end of 1920 the total electrical power developed by hydro-electric companies in Japan was 1,254,000 kW. The total power licensed for development by these concerns was 2,756,000 kW. Many millions have been invested in hydro-electric works. The Yokohama electric railway is but one of several electric railways in the country, but it has made the district between Tokio and its port "one long industrial village."

The European war caused considerable industrial development in Formosa. The Japanese have certainly pushed ahead with engineering projects in that large island, which was practically undeveloped when under Chinese rule. The Formosan Government has the supply of electricity under its own control. In 1917 there were four hydro-electric schemes in working order averaging from 3,000 to 4,000 h.p. each. In 1920 a semi-official limited company commenced work on the Lake Candidius scheme, which will give a maximum of 100,000 kW. Labour in Formosa is plentiful, and on constructional work is paid at the rate of about 2s. 6d. a day. Another company has 7,500 kW, for which a contract has been let. The locality is so favourable that the cost of erection of the installation is about £50 per kW.

The development of the huge tracts of agricultural lands in Manchuria, where the Japanese control the railways, has been phenomenal. In these vast agricultural districts the mechanical and the civil engineer do the pioneer work, but the demand for electrical machinery inevitably follows.

The Future.—There are the young men "out from home" who come to the Far East to join a business firm, hoping to make a fortune in about seven years, and then retire in affluence. They are disappointed; but, if industrious, they usually retire in due course quite well off. Sometimes, by lucky speculations, they do make wealth quickly. There are the representatives of engineering firms; sometimes they know little about the technical details of the goods they wish to sell, and usually they know nothing of China and the Chinese. They also become disappointed, finding that business is not to be had for the asking. The old days of luxurious profits and much idleness while waiting for mails have gone. The cable and the fast steamship have accelerated competition. The lure of the East still holds, and there will yet be fortunes for the men of commerce—victories with rich rewards for the energetic and industrious. The Far East must always be attractive to the Westerner if only because of the characteristics of the place and people that will survive all changes. For the engineer the Far East has this great charm. He can see that he is doing good work, and the natives with whom he works are decidedly likeable. If the engineer is an Anglo-Saxon, he will see ample evidence of the results of the efforts of his own country.

Each cycle of Cathay, each jubilee that we celebrate, pushes our thoughts alternately forward and backward. Looking ahead to the next 50 years we see that the Far East will be an entirely new world. Everywhere there will be electrical apparatus. It is not unreasonable to suppose that vast areas of Southern and Eastern Asia, which are now desert, jungle, or waste, will be made productive. It is not realised that electric fans, freezing machines, and similar fittings have made the tropics "liveable" for the energetic white man. He is "cleaning up" the dark places of the earth. Electricity is helping him in every way. It is not improbable that hydro-electric schemes will supply energy for the stimulation of crops. The people of the Far East will learn to revere the names of Faraday and Kelvin as for thousands of years they have paid homage to the names of Confucius and Mencius. May the transformation take place quickly and may British engineers and British machinery play a very prominent part in it.

A MODEL WATER-POWER INSTALLATION.

One of the most interesting little country house installations we have heard of for a long time is that at "Blarich," Rogart, Sutherland, the property of Mr. James Menzies.

Through this property, at a distance of 150 yards from the house, runs a mountain burn. Like nearly all Highland burns, the flow in this varies greatly; at times it is a raging torrent, at other times only a tiny stream, and it is a matter for careful consideration to decide on the size of plant best fitted to utilise the power available, especially where, as in this case, no impounding could be done. Investigation and inquiry indicated that the minimum flow in this burn was about 40 cubic feet per minute, and a plant to utilise this was installed. A mile of the burn was surveyed, and the section which could be most cheaply and conveniently developed was chosen. This section was 600 yards in length, and in this distance a gross fall of 67 ft. was obtained. A strong rock-built weir, 4 ft. high and 15 ft. broad at the base, was constructed across the burn, and into this was built a heavy timber sluice, the object of which is to enable the *débris* which accumulates above the weir to be easily cleaned out. A fish notch 12 in. wide and 3 in. deep was left in the weir. When the fish are moving, it is an interesting sight to see them shooting up through this notch into the river above.

Fig. 1.—The Burn.

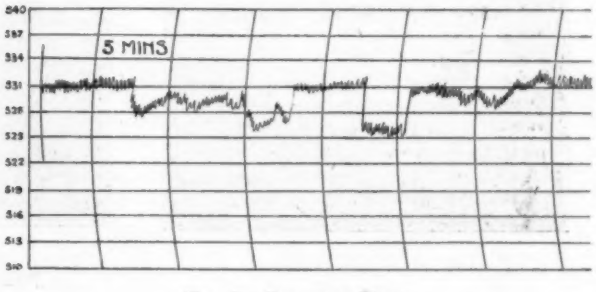


Fig. 2.—Governor Test.

From the weir and intake chamber, a 10-in. stoneware pipe is taken along a contour line above the burn to a point 200 yards down stream, where it terminates in a concrete surge tower. From the latter, an 8-in. steel pipe is taken on neat steel supports built in rock piers

across the burn to the left bank, whence it goes in the straightest possible line to the power house, a distance of 400 yards.

The pipe track was not an easy one to cut, owing to the huge masses of granite encountered in places just below the surface. These all had to be removed by explosives.

The power house, which is of pretty design and well arranged, stands on the bank of the burn, and is built of stone with slated roof and tiled floor. It is connected to house and cottages by telephone cable, a laryngaphone being fitted in the engine room. The power house contains plant consisting of an impulse turbine with shaft

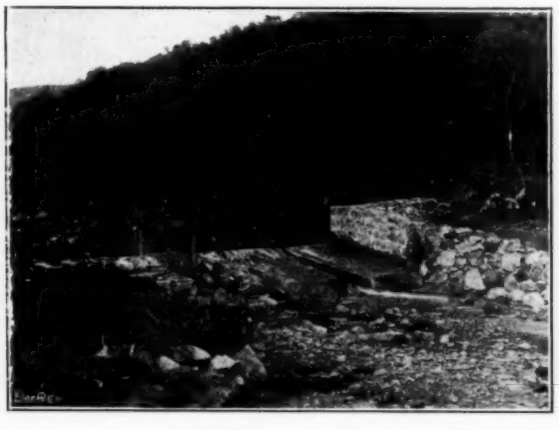


Fig. 3.—Weir and Intake.

Fig. 4.—Surge Tank and Pipe Line.

governor, by Messrs. Gilbert Gilkes & Co., Ltd., direct coupled through flexible coupling to a dynamo by Messrs. Electromotors, Ltd. The turbine develops 4½ b.h.p. with 50 c.f. per minute, the working head being 62 ft.

The dynamo is compound wound and oversize for the turbine, its output being 30 A at 110 V compound, or 24 A at 160 V shunt, at a speed of 520 r.p.m. Both machines are fitted with ball bearings. The shaft governor, fitted to the turbine, is of an improved self-lubricating type, and has proved most sensitive, as will be seen from the chart (fig. 2), the maximum variation being only 6 revs. over the whole range of load. When running direct, not the slightest flicker on the lights can be observed. A slate switchboard on angle iron frame and fitted with large moving-coil instruments controls the current, conveyed to the house—220 yards distant—through a three-core steel-armoured cable, and here is fixed a complete house lighting switchboard in the main corridor. The board contains the usual instruments, battery regulating switches, ampere-hour meters, &c., and also all the house circuits. An additional field regulator is also fitted on this board, enabling the battery charge to be adjusted, or the dynamo output altered when running in parallel, as is done when sawing.

A battery of 54 cells of 160 Ah capacity is housed in an outside battery room. This is used during the summer months, when the days are long and hardly any light is required. It is also called on when, as sometimes happens, the intake gets blocked with leaves or frozen snow.

The lighting installation, carried out in the Henley wiring system with sunk iron switch boxes, consists of about 100 lights in house, stables, byres, workshop, garage, and cottages. In addition, there is a 3-h.p. motor-driven saw for firewood, and a ½-h.p. motor for the churn, separator, and refrigerator. Free use is made of apparatus such as coffee percolator, kettles (3), irons (2), hotplates, toasters (2), and bowl fires (2), and there is an immersion heater fitted in one of the water storage tanks for use when there is current to spare.

It is most interesting to find that such a small burn as that at Blarich, properly developed, will give a supply almost equal to that from a public main at a very small cost. Unstinted use of light and appliances is made. It would be hard to find a more complete little installation than this, and it ought to encourage others who have available water power to go on and develop it.

The installation was carried out by Edmundson's Electricity Corporation, Ltd., to the plans and specification of Mr. E. J. Williams, Scottish district manager.

Fig. 5.—Power House.

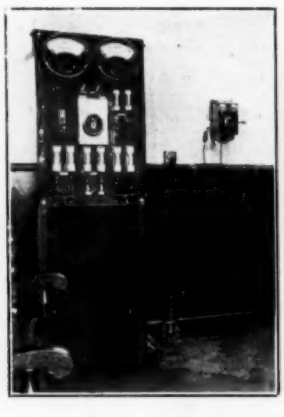


Fig. 6.—Switchboard in Power House.

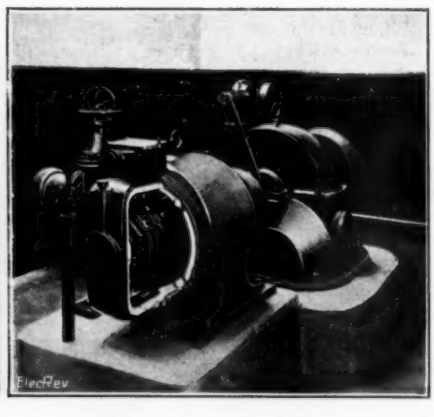


Fig. 7.—Generating Set.

Telephone Works in Hungary.—According to the papers, the L. M. Ericsson Co.'s affiliated Hungarian concern is to re-obtain possession of its large factory at Budapest which was requisitioned in 1914. The factory manufactures telephone and telegraph apparatus.—*Reuter's Trade Service* (Stockholm).

THE IMPROVEMENT OF POWER FACTOR.

By the late Dr. GISBERT KAPP*, Past President.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Whether consumers' individual motors have a good power factor or not does not directly concern the supplier of electricity; all the latter asks is that consumers shall take from his terminals a current nearly in phase with the voltage; this condition the consumers can always fulfil, but that all consumers on a system should voluntarily incur the expense involved cannot be expected. The supplier must, therefore, make it worth their while, and thus the purely technical question of p.f. improvement becomes tied up with the question of suitable tariffs.

The introduction of power-factor improving devices necessarily involves capital expenditure, but it reduces the capital cost of the electrical part of the generating and transmitting plant. Where the supplier is also the consumer, the relation between extra expense on the consuming plant and saving of expense on the supply plant is direct and obvious. In the case of a supply company and its many consumers this relation may not be so obvious. Nevertheless, the relation exists. If the customer cannot participate to a reasonable extent in the benefit he confers by installing plant of good power factor, he will naturally refrain from doing so.

The economical limit of power-factor improvement does not depend on the power factor of the unimproved plant, but only on the ratio of the cost per kW of the original plant at its power factor to the cost per wattless kVA injected by the phase advancer.

If c = capital cost of generating and transmitting plant per kW and C = cost of phase-improving plant per wattless kVA, then writing $a = c/C$ it is economical (from the capital outlay point of view) to go on improving the p.f. until $\sin \phi = a$, where ϕ = the angle of lag. The saving thereby effected = $100\ [1-\cos(\phi_0-\phi)]$ per cent., where $\cos \phi_0$ = original p.f. before improvement.

Since a is generally very small (say, within 0.1 and 0.3) p.f. improvement may economically be carried fairly near to unity p.f., but should not be carried beyond it so as to make ϕ negative. This refers to the installation as a whole, but does not mean that any individual motor may not be worked with a leading power factor if thereby the overall p.f. can be brought up to the economic limit.

Let K be the cost of the original plant without any improvement, and s be the saving in capital outlay through using phase advancers. Then the following table shows the saving in capital outlay effected by power factor improvement for a few values of a and $\cos \phi_0$:—

$\cos \phi_0$ ...	0·6			0·7			0·8		
a	0·1	0·2	0·3	0·1	0·2	0·3	0·1	0·2	0·3
s/K per cent....	32	24	18	22	16	11	14	9	5

The cost of p.f. improving plant per kVA varies within wide limits; it may be as low as 10s. with a phase advancer applied to the slip-rings of a very large induction motor, or it may go up to £4 or £5 with static condensers. The essential condition is that we must not depart too widely from the rule $\sin \phi = a$, *i.e.*, when the total cost (excluding consuming devices) of the electrical plant per kW becomes a minimum.

With regard to the apparatus used for p.f. improvement:

Rotary Condenser: The largest machine yet built has a capacity of 30,000 kVA when used to advance the phase of the current, and 20,000 kVA when used to retard the phase.

I am not aware of any instance where a consumer drawing his supply from a thermic works has put a rotary condenser on his own premises for p.f. improvement; and the reason is not far to seek. The consumer has to pay not only for the energy he consumes in his motors, but also for that which he wastes in his rotary condenser, and that is a considerable amount. A rotary condenser of some hundreds of kVA cannot be worked with a smaller loss than a generator of equal output. The loss in kW may be between 6 and 7 per cent. of the output in kVA. Therefore, the installation of rotary condensers by consumers is financially unsound. That rotary condensers are successfully used by supply companies is not due to financial reasons, but to the absolute necessity of giving their distant consumers a constant-voltage supply, for which purpose, in the present state of the art, the rotary machine is the only available apparatus.

Static Condenser.—The static condenser requires no attention, and has, in this respect, a great advantage over any rotary machine, and its own waste of energy is exceedingly small. The cost varies inversely with the frequency and the square of the voltage per element.

The following data as to cost have been supplied by the makers for a condenser equipment of 100 kVA output, including tank and switchgear, all at 50 frequency:—

Voltage at supply terminals ...	600	440	440
Transformer	Not used	Used	Not used
Condenser voltage	600	600	440
Cost	£336 13s. 4d.	£468 8s. 4d.	£280 5s. 11d.

Synchronous Induction Motor.—This type of machine serves the double purpose of providing motive power and, at the same time, injecting leading kVA into the supply terminals, but its cost must always be greater than that of an ordinary induction motor, and the difference in cost must be the greater the smaller the leading power-factor required for full normal load. Its efficiency is a little lower owing to the greater loss in excitation. The various makes differ in detail, but the main principle is the same.

Rotary Converter as Phase Advancer.—The use of this type of machine for injecting leading kVA into the supply line is rather limited on account of the rapid increase of the copper losses in the armature with an increase of the wattless component given to the line, and p.f. improvement can only be obtained at a sacrifice of output. Economically it is better not to use a converter for giving to the line leading kVA, but to be content with taking from the line true kW and thus raising the general p.f. of the system by increasing the watt load. Moreover, a converter excited to unity power-factor will scarcely influence the line voltage at all, whilst a converter injecting leading kVA may have some disturbing influence.

Slip-ring Phase Advancer.—Neglecting losses, which are very small, a phase advancer having an output of 6.3 kVA will benefit the line to the same extent as a static or rotary condenser giving it 250 kVA. At the same time the overload capacity of the motor is increased. There are two types of slip-ring phase advancer in use, the rotary and the oscillatory. The former is an a.c. commutating machine which must be driven from some external source of power, the latter is a d.c. machine which requires no external driving, but needs d.c. excitation from an external source.

Rotary Phase Advancer.—The Scherbius rotary phase advancer has no stator, but the iron core of the armature is radially extended beyond the armature conductors, so that the rotor iron outside the winding performs the office of an external stator. Since the magnetic reluctance of the air-gap is thus avoided the advantage of a strong field with only a moderate excitation is secured, but there is the disadvantage that the commutation necessarily takes place, not in the neutral space, but in the strongest part of the field, making the commutation more difficult than in an ordinary d.c. machine. The fact that not a direct but an alternating current must be commutated is of little importance, because the frequency of this current is so low that the condition as regards commutation is practically the same as with d.c.

If the rotor is at rest the machine acts simply as a choking coil. If the armature is rotated by external power with slip frequency the machine acts simply as a dead resistance. By increasing the impressed speed, so that the winding rotates with a speed greater than that of the field, the e.m.f. generated changes sign, that is to say, it leads relatively to the current by a quarter period. Saturation avoids excessive phase advancing at heavy load and yet obtains a satisfactory power factor at lighter loads; the overload capacity is sensibly increased.

Oscillatory Phase Advancer.—The author's phase advancer, more generally known under the name "vibrator," has already been described. Its action is simply that of a condenser of very large capacity, and as this capacity has a fixed value for every type, even for light loads, a good power factor can be obtained with an induction motor by adding a vibrator.

The phase-advancing effect of the vibrator depends on the square of the flux, and is inversely proportional to the mass. This points to the use of two-pole armatures of small diameter and comparatively great length. The proportion found in practice to be suitable is about 1 to 2. Since the air-gap can be made very small the power required to produce the strong field is not very large; it varies between ¼ and 1 kW, which means from 0.25 to 0.1 per cent. of the power of the motor. The connection of the vibrator with the slip-rings may be either in star or in delta, depending on which comes nearest to the given full-load rotor current, but as a general rule delta connection is preferable because of the smaller current. As the vibrator is essentially a low-voltage machine it is advisable to make it the star point of the rotor circuit. Where the rating is fixed with regard to short-time overloads the increase in rating may be considerable (20 to 30 per cent.) so that the cost of a motor with phase advancer will not appreciably exceed that of a larger motor without phase advancer.

The power lost in the phase advancer is very small, and is

* Dr. Kapp died on August 10th, 1922; the paper was read by Prof. Miles Walker, M.I.E.E.

approximately compensated for by the saving in stator copper loss.

Meters and Tariffs.—In order to ascertain the general trend in the supply industry as regards discriminative tariffs, the author made inquiries of some of the larger power companies with the following results: On the whole the importance of framing the tariff so as to induce consumers to take their supply under a good power factor is recognised, but the question is (owing to the unsettled industrial condition) still in a state of flux.

The examples of tariffs cited (in the original paper) show that the tendency in the supply industry is rather in the direction of a fixed charge for the maximum demand, augmented by a flat rate per kWh, than only a flat rate adjusted according to power factor. The latter is unscientific and can, in some circumstances, be unfair to either the consumer or the company, but anomalies cannot occur under a maximum-demand tariff. The consumer may leave his condensers in circuit permanently without depriving the company of a certain percentage of the revenue to which it is entitled, because the fixed charge is not influenced, or is only slightly influenced, by energy factor. For the same reason the consumer cannot be penalised for doing a little more phase advancing than is necessary. The basic idea of the two-part tariff is that the fixed charge for maximum demand should recompense the company for capital outlay incurred on account of each consumer, whilst the flat rate per kWh recompenses it for running costs. If the voltage at consumers' terminals is kept constant the maximum kVA demand can be found from a maximum-current indicator scaled in kVA. Under these conditions the metering becomes very simple. All that is wanted is a coulomb meter combined with a time element which brings the pointer back at regular intervals of 10 or 20 minutes, leaving the indicator in its farthest position, and an ordinary cosine energy meter. Neither energy factor nor power factor enters in the making-up of the total charge, and the customer can by inspection of the two meters find out for himself what energy he has used and how much he has to pay for it. This is an advantage, especially with small consumers, who cannot be expected to understand the mathematics of power and energy factors.

The condition of constant terminal voltage may not, however, be strictly maintained. The error thus introduced by excessive voltage drop may be appreciable and, as it is always against the consumer, most supply companies replace the simple (coulombs)/(time) indicator by a (units)/(time) indicator, and translate the reading into maximum kVA demand with reference to the energy factor by dividing the number of kWh by $\cos\phi$. Under this more accurate system of metering three instruments are required: (1) A maximum-demand kW indicator which is a cosine meter with a time element; (2) an ordinary cosine energy meter; and (3) a sine meter to record $fEI \sin\phi dt$. From the two last-named instruments is found $\tan\phi$, and from this $\cos\phi$.

If P_0 = maximum kW demand, P = maximum kVA demand, m = charge per maximum kVA demand, U = number of units consumed, d = flat rate, then $P = P_0/\cos\phi$; and the total charge = $mP + dU$.

Under this tariff there is no necessity to place the consumer under any restriction as to a minimum power factor. The latter may be as bad as suits the customer's method of working his machinery, because its effect will make itself felt in the energy factor and thus appropriately increase the fixed charge, thereby recompensing the supply company for its greater expenditure on electrical plant.

Discussion in London.

Mr. Ll. B. Atkinson, in opening the rather disappointing discussion, referred to the late Dr. Kapp's early work, and mentioned that, although physically he failed rapidly at the last, mentally he was as alert and keen as ever, as the paper under discussion proved; even after his death they were still learning from him.

Dr. S. Parker Smith pointed out that power-factor correction was not only an economic question, but was becoming a necessity on certain systems. He drew attention to two papers that were presented in 1909, in one of which Mr. Morley came to the same conclusion as Dr. Kapp had done, and to a set of curves published by a Swiss electro-technical society which brought together very conveniently the results of various methods of charging for power.

Mr. K. Edgcumbe spoke with reference to the maximum demand tariff and the use of a coulomb meter combined with a time element. The terminal voltage was not always maintained strictly constant, and it was questionable whether Dr. Kapp's suggested method of overcoming the error thus introduced would be more accurate because it introduced complications. There were two evils: first, pressure variation; and, secondly, the power factor indicated would only be the average, and not the true power factor at the time the consumer made his maximum demand.

Mr. W. E. Rogers suggested that the use of static condensers was not a commercial proposition at a lower pressure than 600 V; also one constantly came up against the difficulty of master patents in that connection.

Mr. E. T. Williams stated the conditions that led him to install a static condenser to improve the power-factor of an installation; it had given no trouble whatever. All agreements for the supply of power should, he thought, be on the kVA basis.

Mr. W. B. Woodhouse explained that 18 years ago he adopted the kVA basis of charging for power. Two questions were: Who was to provide the idle power, and who should do the power-factor correction—the consumer or the electricity supply authority? In his opinion it should be made prohibitive in price for a consumer to have a low power-factor. He knew of a case in which the provision of condensers had reduced the power bill by £8,000 per annum, and in another case a synchronous motor had resulted in a saving of £2,000 a year being made; both installations had given satisfaction for a number of years.

Mr. W. E. M. Lipman described and illustrated by means of lantern slides a new type of power-factor meter that had been developed on the Continent; it was known as the Lipman pattern.

Mr. W. M. Selvey agreed with Mr. Woodhouse that it should be made prohibitive in price for a user of electricity to have a bad power-factor; his experience was that if they told users frankly that they were abusing their privileges, without going into detail or even mentioning power-factor at all, they would find them sympathetic and reasonably willing to help the electricity supply authority. After referring to methods of metering and measurement of power-factor with accuracy, he expressed the opinion that they should separate the technical question from that of policy.

Mr. C. L. Ayres advocated the improvement of power factor by the re-grouping of existing motors, so as to utilise them to their best advantage; in the U.S.A. that was always the first way of tackling the problem, but, of course, that was not always possible.

Prof. Miles Walker, in briefly replying to the various questions raised, expressed the opinion that power-factor correction would eventually be carried out by means of the phase advancer, but they would take thirty years to wake up to the fact that that was the best solution.

Discussion at Newcastle-on-Tyne.

At a meeting of the North-Eastern Centre of the Institution (Mr. F. G. C. Baldwin in the chair) Prof. Miles Walker read the late Dr. Kapp's paper.

Mr. J. M. Heslop, in opening the discussion, said that as a supply system became more extended the importance of power-factor became a matter of most serious moment. The types of machines for improving the factor had good points, the value of which it was difficult to estimate, which, with plant of the present-day dimensions, became rather embarrassing. The consumer could not be absolved from all complicity in the troubles arising from a bad power factor; a man who took an excess of magnetising current should pay for so doing, and Dr. Kapp's methods enabled them to do this. He emphasised the fact that a bad power factor involved a wasteful consumption of coal, and also there must be some unproductive capital concerned, which might otherwise be spent on connections, &c.; as a matter of fact, a man with a good power factor was bearing more than his share of the expenses. The supply authorities should impose a stiff penalty for a bad power factor, and give some reward for a good one.

Mr. Thomas Carter thought particularly useful the section of the paper dealing with synchronous induction motors, because of the details of designs collected therein, and because of the clear way in which it showed that that type of machine, to have a respectable overload capacity, must work at a leading power-factor; or, if that was undesirable, an abnormally large machine, correspondingly expensive, must be chosen. All through the counsel was to effect power-factor improvement with discretion, and not to imagine that the more the power factor could be increased the better. When correction had to be applied to an existing installation no nice balancing of relative costs was usually possible, and only a rough approximation could be made to the most economical amount of improvement. The curve of relative rates of change of $\tan\phi$ and $\cos\phi$ was approximately horizontal between $\cos\phi=0.6$ and $\cos\phi=0.95$, both lagging, and practically exactly so between $\cos\phi=0.70$ and $\cos\phi=0.90$, and the correction required for a given amount of improvement was reasonably constant within that range of values. Outside of it, however, including a change from lagging to leading power-factor, the kVA required for a given correction became excessive. There was much to be said for the principle that a consumer should not be penalised because he was a small motor man, whose installation would tend to work at a lower power-factor than that of the large motor man. The vital question was whether each man was doing his electrical driving in the best possible way. If anyone's power-factor was needlessly low for his type of installation he ought certainly to pay for that bad design, but so long as he did the best for his own job the suppliers ought to be satisfied, without wanting to charge more per kWh because of things over which he had no control. After all, power-factor difficulties arose because suppliers used a.c., and that they did for their own convenience, and not for that of their customers. The paper suggested that low power factor was detrimental to both supplier and consumer, but the speaker suggested that the bulk of the burden was on the supplier, and it was of his own choosing. The speaker was inclined to fix, not unity power

factor in every case as the ideal, but some figure suitable to the installation, perhaps as high as 0.95 in the best cases, and as low as 0.75 in the very worst, depending on the average size of motor that ought to be employed for the work, and its usual best commercial power factor.

Mr. P. F. Allen pointed out that, arising out of what the last speaker had said, it seemed to be a matter that the supply authorities should deal with. It cost so much to supply the energy, and so much to supply the wattless current, and it was for the suppliers to say what the cost was and charge for it accordingly.

Mr. P. B. Maclean referred to the cost of installing a rotary condenser for the improvement of a bad power factor, and said it raised the question at once whether or not the improvement was worth the cost. The cost was put down by the author at £2,100, but the speaker thought that it could be done more cheaply now, and labour charges could be cut altogether in some cases. In a colliery the electrician only looked into the power-house once or twice per day, and that was the only attention the machine got.

Mr. G. L. Porter thought that tariffs might be looked into; a.c. gave a cheaper supply than did d.c., and of that cheapness the consumer got the benefit; therefore it was as much for the consumer to pay his share of the cost entailed by a bad power factor as for the supply authority.

Mr. R. D. Spurr said the paper should be brought plainly before the consumer; it should be re-written in such a way that its real meaning would come home to him. All users of motors tried to keep on the "safe side" by using a motor larger than was needed. Manufacturers seldom gave advice as to the exact size of motor that was requisite for the work to be done.

Prof. M. Walker, in replying to the discussion, thought one reason why so little had been done to improve power factor in the past was that the power supplier had not made it worth while for the consumer to improve it. A phase-advancer was suggested in 1896 by Le Blanc, but no one made it worth while for the consumer to use it, and it had only been fitted where there was an especial reason for it. It was for the power suppliers to make it worth the consumer's while to improve the power factor and then it would be done.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Expanding Pulley.

Among the exhibits at the recent Textile Exhibition, Manchester, was an expanding pulley produced by The Expanding Pulley & Electric Co., Thornhill Lees, Dewsbury. This consists of segments fitted between two circular plates with radial slots, adjustment being made by a striking gear, which opens or closes the segments as required by sliding them in the slots. By this means a variation of 60 per cent. can be made in the speed—employing one pulley to drive a similar one. The actual expansion is effected by a thrust plate (provided with a ball thrust) which operates internal cones; these slide along the boss or barrel and operate on a tapered surface on the underside of the segments. Each set of segments is turned when at its least diameter, so that, as expansion takes place, the edges cannot cut the belt, as the radius of each segment is less than that of the pulley as a whole. Centrifugal action is overcome by means of specially-designed springs, housed in a malleable cast-iron flange ring and enclosed by an aluminium guard. The gear can be arranged for automatic operation. An application of the pulleys is seen in the accompanying illustration (fig. 1).

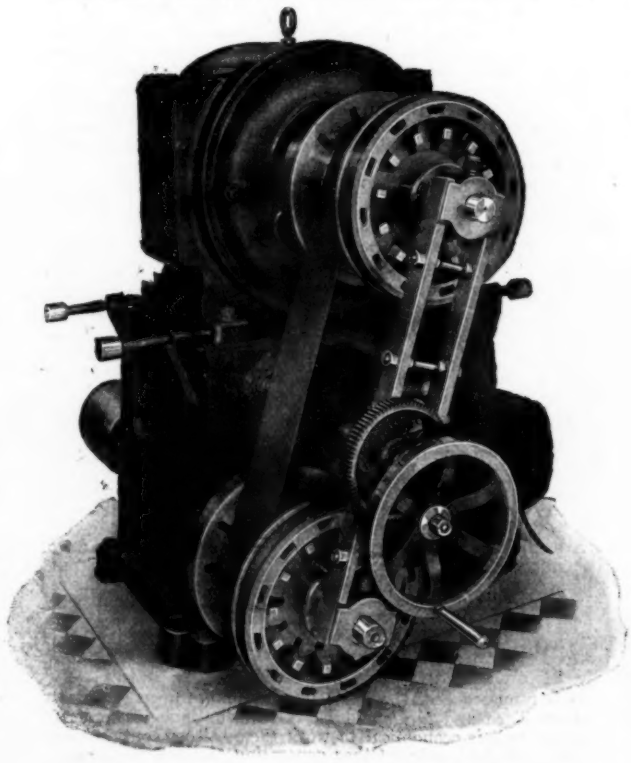


Fig. 1.—An Expanding Pulley Gear.

The "Reako" Heater-Toaster.

The "Reako" electric fire, which can be used in two positions, has been put on the market by the Russell Electrical Appliances Co., Ltd., Alliance Mills, Belfast Road, Stoke Newington, N.16. Fig. 2 shows the appliance in the position for general heating. The end plates are of substantial construction, and can be supplied plated in almost any finish desired. The spiral element wire is secured in grooves in the refractor bar. This bar is built up in sections on steel rods, and is of a registered design. Over the element are four bars to support the utensil or to serve as a rest when bread is to be toasted. A hinged guard effectively protects the element when the appliance is required as a fire, but can be thrown back when cooking operations are in hand. The provision of heat-insulating feet enables the device to be placed on a highly polished table without fear of scratching or scorching. The loading is approximately 600 watts.

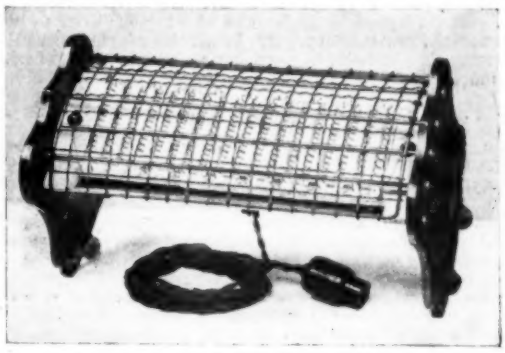


Fig. 2.—The "Reako" Heater-Toaster.

An Electrically-driven Air Compressor.

Fig. 3 shows a compact electrically-driven air compressor recently put on the market by Messrs. Marshall & Plumtree, Ltd., 20, High Holborn, W.C.1, a feature of which is that the compound-wound motor is coupled through gearing with the compressor, the whole being assembled in a totally-enclosed dust-proof housing, the top cover of which is in sections and can easily be removed for inspection purposes. These machines are made in two sizes, to give outputs of 6 cu. ft. of air per minute at 150/200 lb. pressure, and 12 cu. ft. per minute at 50/75 lb. pressure, and for running on direct-current circuits of 110 V or 220/240 V. The outfit is suitable for stationary work or it can be easily rendered portable by mounting it on a trolley. No water cooling is required; the cooling is effected

Fig. 3.—An Electrically-driven Air Compressor.

by air circulation, which is drawn from the outside atmosphere by means of a fan on the armature shaft and circulated round the compressor cylinder walls and then expelled at the orifice below the two head valves; the high-pressure air is cooled by means of a ribbed expansion chamber on the delivery side. All lubrication is effected by grease to the ball-bearings and other working parts, and the plants will run continuously without any attention for long periods. An important point is that only pure air free from oil vapour is delivered from the machine.

The "Pryco" Flashing Adapter.

A device of great utility to those who use intermittent or "flashing" electric signs has been put on the market by Pryco, Ltd., 14, Shouldham Street, Edgware Road, W.C.2. The invention is an extremely simple one, consisting merely of a thermostatic contact device contained in a lampholder which differs only from the standard type by the length of its barrel. The thermostat itself is contained in a little glass tube not more than 1 in. in length. A small heating element of high-resistance wire is twisted round a bi-metal contact which opens upon being heated, thus breaking the circuit, and closes again when cool. A sample tested by us with an ordinary m.f. 60 W lamp functioned satisfactorily, giving alternating periods of light and darkness of nine seconds' duration. The adaptor is made in a number of sizes to take currents of from 0.125 to 7 A. It can be adapted to work a four-way sign showing advertising matter in three flashes, the fourth illuminating the whole sign.

The "Ripolite" Reflector.

The "Ripolite" reflector recently marketed by the Electrical Products Co. (London), 20, Goswell Road, E.C.1, is a corrugated metal fitting, the interior of which is silvered, the outside being enamelled. At the top of the reflector is a dome, into which a vertical-filament electric lamp can be fitted. Comparative tests with a number of other commonly-used reflectors carried out at Faraday House, show that the "Ripolite" reflector possesses many points of superiority. The vertical candle power obtained with the use of a 100-V, 60-W m.f. lamp was 171 as compared with 115 in the next best. The lower mean hemispherical candle power was 72.5 as compared with the next highest of 60.2. The infrangibility of the reflector is another advantageous feature.

A Gas Engine Power Set.

Messrs. Holes, Ltd., Netley Abbey, Southampton, are putting on the market a complete power unit of 100-kW capacity, comprising a six-cylinder vertical gas engine running at 440 r.p.m., developing 150 h.p., connected on a one-piece bedplate to a 100-kW dynamo of open multipole type, compound wound, having a full load efficiency of 91.75 per cent. Gas is supplied by a producer of ample capacity to give a continuous supply of gas at full load, the fuel consumption being .9 lb. of anthracite per h.p.-hour. The unit consists of all fittings, including a hand compressor for initial charging of air starting receivers, and cooling tanks of 2,000-gal. capacity.

EAST SCOTLAND ELECTRICITY DISTRICT.

Edinburgh Corporation's Scheme.

In February, 1922, the Electricity Commissioners provisionally delimited the above-named area* in connection with which they are to hold a local inquiry at Edinburgh on December 12th, and at which they will also consider a draft scheme for the reorganisation of the supply of electricity within the district that has been submitted by the Corporation of the City and Royal Burgh of Edinburgh.

In an explanatory memorandum it is pointed out by the Corporation, *inter alia*, that it is in point of fact the only undertaker which supplies electricity on a large scale within the district, and it is prepared and in a position to generate and supply electricity for the whole of the district.

The Corporation is erecting a large generating station at Portobello, which is or can be made capable of fulfilling the functions of a capital station from which supplies of electricity can be afforded for the whole of the district. The site has sufficient space for a station having an ultimate capacity of 100,000 kW, and the adjacent ground can be utilised for coal sidings or by-product recovery plant. The station is to be erected in sections. The first, which is believed to be sufficient for present needs, is expected to be in operation within a few months. In it three 10,000-kW turbo-alternator sets are being installed with the requisite boiler plant, &c. No other station is or will be necessary.

The whole of the financial responsibility for the erection of the station has been undertaken by the Corporation, and the necessary borrowing powers have been authorised partly by the Secretary for Scotland and partly by the Electricity Commissioners.

With the exception of the Corporation's existing area of supply, the electrical requirements of the district have not been developed to any great extent. The generating stations in the district other than those of the Corporation consist of: (1) a station of the Musselburgh & District Electric Light and Traction Co., Ltd., at Musselburgh, with a capacity of 600 kW; (2) a station of the Lothians Electric Power Co., at Bonnyrigg, with a capacity of 150 kW; (3) a station of the Electric Supply Corporation, Ltd., at Dalkeith, with a capacity of 110 kW; (4) a station of the North Berwick and District Electric Light & Power Co., at North Berwick, with a capacity of 30 kW; and (5) a station of the Linlithgow County Council, at Uphall, with a capacity of 150 kW.

The Corporation has an agreement with the Musselburgh and District Electric Light & Traction Co. under which a bulk supply of electricity will be given to the company from the Portobello station, and the existing station of the company at Musselburgh will be closed down as a generating station.

There are two power companies within the district. The Lothians Electric Power Co., incorporated 1904, as authorised to supply energy (*a*) to authorised undertakers in bulk; and (*b*) to persons requiring a supply for power. Its authorised area of supply consists of parts of the Counties of Mid-Lothian, East Lothian, Peebles and Lanark and is a very extensive one, but, with the exception of the above-mentioned small plant, is has not made any provision for meeting the requirements of its authorised area of supply.

The Scottish Central Electric Power Co. was incorporated in 1903, and its authorised area of supply consists of the whole of the Counties of Linlithgow and Clackmannan and portions of the Counties of Dumbarton and Stirling. It is understood that it gives supplies of electricity in the western part of the County of Linlithgow, but its operations have not extended to the portion of that County which is included in the district as provisionally determined by the Commissioners.

The draft scheme of the Corporation is submitted on the following basis, *viz.*:—That the new station at Portobello will be the capital station for the district; that the Corporation will retain its ownership and control and will continue to distribute electricity within its existing area of supply; that the Corporation will be prepared to give supplies of electricity in bulk to existing authorised distributors within the district and that, as regards the parts of the district where there are no existing authorised distributors or which are not yet developed, arrangements will as far as practicable be made for distribution being effected by authorised distributors and the Corporation will be prepared to assist in making such arrangements; that a Joint Electricity Authority will be set up for the district on the footing that such a Joint Authority will delegate to the Corporation its powers and duties as to the generation and supply of electricity other than with respect to the distribution of electricity in the district outside the Corporation's existing area of supply. It is proposed that such delegation shall be made under the provisions of the clause in the Electricity (Supply) Act, 1922, the marginal note whereof is "Mode of exercise of powers by Authorities." ceding the date of the election.

The Corporation also proposes (in view of the provisions of Section 14 of the Electricity (Supply) Act, 1919, and of Section 68 of the Lothians Electric Power Act, 1904), that there shall be excluded from the area of supply of the Lothians Electric Power Co. such portions of that area within the district as are not being supplied by the company.

The chairman of the Joint Authority shall be appointed by the Authority from its members. There shall be thirteen members, ten of whom shall be appointed by the constituent bodies mentioned in the following proportions:—

(i) City and Royal Burgh of Edinburgh, 8; (ii) the County Council of Mid Lothian, 1; (iii) the County Council of East Lothian, 1.

The remaining three members shall be elected by the authorised undertakers within the district other than the Corporation. The basis of voting power for the election of the elected members shall be the number of kWh sold within the area by each authorised undertaker during the year preceding the date of the election. No member shall represent more than one constituent body.

The main outlines of the technical scheme are specified as follows:—

The system of supply will be three-phase a.c. at a frequency of 50 cycles per second. The primary transmission pressure will vary according to the distance of the region supplied from the generating station. In the neighbourhood of the capital station at Portobello it will be 6,600 volts. An increased primary pressure may be used for long-distance transmission up to 33,000 volts. The distribution for traction will be by conversion to d.c. For industrial purposes energy in bulk may be supplied untransformed, if required, and for lighting in outside areas l.p. a.c. will be used. The cables will be three-core, paper-insulated, lead-covered and armoured, and will generally be laid direct in the ground. In special cases, unarmoured cables may be drawn into ducts. A balanced system of feeder protection will be adopted. In outlying parts of the district overhead transmission may be used.

It is proposed that the older stations of the Corporation at Dewar Place and McDonald Road will continue to be used so long as it is economical to work them, either continuously or on peak load only. Other generating stations in the district belonging to various authorised distributors may be discarded.

* Elec. Rev., March 3rd, 1922; p. 305

It is not proposed to erect any further generating station than that now under construction at Portobello. Neither is it proposed to ask the Ministry of Transport to construct any works under Section 18 of the Act of 1919. The railway companies in the district have not yet taken into consideration the question of the electrification of their railways. The Portobello station would, however, be competent to supply all such electricity as might be wanted for this purpose.

THE QUALIFICATIONS OF A SALESMAN.

Similar conferences upon salesmanship to those organised by the E.D.A. in London are being held at Newcastle-on-Tyne, and at the second of these, which was under the chairmanship of Mr. H. Marryat, M.I.E.E., Mr. Angus Watson, J.P., was the principal speaker.

Mr. Watson said that his experience was that no matter how good a product was, and no matter how perfect the factory organisation, without an efficient selling organisation the business would not reach the desired success. The most important part of a selling organisation was the choice of the right men. There were no definite tests which could be applied—each individual's work had to speak for itself. If possible, salesmen should be selected from the staff—they would then have an inside knowledge of the business. It was a mistake to think that technical knowledge was essential, although it was very helpful. The ground should be plotted out for salesmen, and whatever business came from a man's district, whether direct or by other ways, should be credited to him. The speaker thought that salesmen should be remunerated by salary and commission. If the salary was too big they would not feel inclined to work so hard; a commission gave them an interest in the amount of sales. It was important to have both inside and outside sales managers to watch and compare the work of salesmen. These managers would get each man's assistance, and collect information of use to all. Daily reports, although sometimes regarded with suspicion, were useful to enable the head office to follow up visits to prospective consumers with letters.

Mr. Watson said that he was a great believer in periodical sales conferences, and his firm held one every year to discuss selling problems.

The common belief that a salesman attained success because of special innate qualities was only true to a certain degree. Nearly all the qualities of salesmanship could be cultivated, and they might be summarised as follows: Enthusiasm, perseverance, unfailing good temper, tact, systematic working, thoroughness, and an intimate knowledge of competitors' goods. A "born" salesman was frequently uncertain in temperament and irregular in his work.

It was of the utmost importance to keep samples in good condition; a new buyer selling them for the first time was predisposed either in favour of or against goods by their appearance. Generally, it was a mistake to leave samples with a customer; this hardly ever resulted in business. The same applied to samples sent by post. Buyers frequently used these devices as means of getting rid of a salesman. The ultimate success of a salesman depended upon the amount of new business he brought in. Every salesman should see that he did nothing to lower his health standard. He should keep himself in condition by steady, regular habits, healthy vigorous recreation, and a mind free from unnecessary trouble. Too much emphasis could not be laid upon the importance of systematic working. Buyers should know when to expect the salesman, so that they would hold up orders until he called. Salesmen should not worry about the collection of accounts, but encourage buyers to remit payment direct to the head office.

It was always advisable to know what competitors were doing, as it was only by this means the salesmen could talk intelligently and forcibly about their own goods. The wise salesman would, however, not talk competitive goods down; indeed, he should avoid such discussion altogether, but if forced to do so, agree that they had merits of their own. Sometimes buyers were exasperating, but the salesman should never lose his temper. On the other hand, it was not wise to become too friendly with customers, as too much time was wasted in this way. Politics, religion, and intimate personal matters should be avoided.

Customers should not be told anything not strictly true, nor should they be left with false impressions. The wisest plan was to let the customer do the talking, his conversation being skilfully guided into the right channels. The salesman should not argue with a customer; it wasted time, irritated him, and never secured sales.

The salesman's personal appearance was very important. He should be neatly, but not elaborately dressed. He should above all, be natural. Enthusiasm was one of the driving forces of salesmanship, for, unless a salesman was enthusiastic about his goods, he could never make his customer so.

In the ensuing discussion Mr. R. Robson agreed that the salesmen should be selected from the staff whenever possible, but he thought that in the contracting branch of the electrical industry technical knowledge was essential in a salesman. Regarding payment by commission, he thought that commission should never be reduced however much a man made. There was one difficulty in their business which did not seem to apply to Mr. Watson's. If they got a customer there was just one order, and not another for many months afterwards. In conclusion, he considered that insufficient attention was given by retailers to advertising.

Mr. Spence said that the salesman in the electricity business had to possess a fair technical knowledge in order to be able to sell goods to technical men. Annual conferences were not sufficient; his own firm held meetings weekly and monthly. He thought that the salesman *was* born to the business; some people could not be trained beyond a certain point.

Mr. Watson said that he wished to make his statement clearer. He meant to say that a man need not be a technical man when engaged as a salesman. If he had the gift of salesmanship he could be technically trained afterwards.

Mr. Pinkney said that Mr. Watson had touched upon a subject which was exercising the minds of men in the electrical industry—whether it was better to take a technical man and give him the sales knowledge, or to get a salesman and train him technically. He, personally, had been of the opinion that the qualities necessary in a salesman could not all be cultivated. His view was that it was easier to give a born salesman a certain amount of knowledge than to train an engineer in salesmanship. It was of importance that a salesman should adapt himself to the customer's point of view. He agreed with Mr. Watson that goods, so far as possible, should be sold on their own merits, and comparisons with competitors' goods should be avoided. The principles enunciated by Mr. Watson applied to all branches of the electrical industry, whether alternators or sixpenny units were being sold.

Mr. T. Carter thought that a good salesman should be a psychologist, able to tell in a moment if he was going wrong with a customer. That being so, he did not consider it possible to put into a man what was not already there. Mr. Watson's principles were applicable to the electrical industry, but there was a difference in that Mr. Watson's firms supplied goods to suppliers of other people, while contractors were selling to people directly. He did not think that technical knowledge was very important, although a salesman should have sufficient knowledge to be able to answer questions. Mr. Carter emphasised the need for the interchange of views regarding different areas.

Mr. Cross considered that technical knowledge was essential as contractors' salesmen had to be in a position to advise non-technical customers. Samples should be taken from stock, and not specially prepared. There was a lot to be learned from the criticisms of users.

Mr. Ellis considered that a successful salesman possessed certain inherent qualities and others acquired by experience. Therefore the salesman was best "caught young," and should preferably be taken from the staff. It was not, however, a matter that could be dogmatised upon. A man ought to be paid at a high standard apart from his commission. He thought that one effect of a high commission and a low salary might be the salesman's concentration on new business and old buyers might suffer. Above all the salesman should provide willing "service."

Mr. Ward gave it as his opinion that technical knowledge was a *sine quâ non* for electrical salesmen. A man selling electric radiators, for instance, should be able to say which was required for a certain room. Only a technical man could get customers out of their troubles.

Mr. Winchester thought that electrical salesmen should operate in pairs—one to sell the current and the other to sell appliances. There should be greater co-operation between supply authorities and contractors.

Mr. Marryat said that there was a great deal of difference between selling an installation and selling switches. In the first case, it was generally business with an inexperienced customer. In his own business he had found it best to have a salesman who could do his own estimating.

Mr. Watson, in reply, said that he considered it a delusion to think that different kinds of businesses required different salesmen. The art was the same whatever the article might be. Frequent conferences between salesmen were advisable if they could be arranged.

B.E.A.M.A. Scholarships.—The Council of the British Electrical and Allied Manufacturers' Association (Incorp.), on the recommendation of its Education Committee, has recently granted the following scholarships for the 1922-23 session, each tenable for one year and carrying a maintenance allowance of £100 and the payment of college fees:—

In Electrical Engineering (Steam Turbo-generators):—L. H. L. Badham, tenable at the City & Guilds (Eng.) College, South Kensington; W. F. Evans, tenable at Manchester College of Technology; R. C. Matthews, tenable at the City and Guilds (Eng.) College, South Kensington; R. Wright, tenable at the City & Guilds (Eng.) College, South Kensington.

In Mechanical Engineering (Steam Turbines):—W. S. Bowers, tenable at Finsbury Technical College; A. R. Bridge-Smith, tenable at the University, Birmingham; J. W. Davison, tenable at Manchester College of Technology; I. H. Hedley, tenable at Armstrong College, University of Durham; H. C. Lack, tenable at Manchester College of Technology; F. D. Roberts, tenable at Manchester College of Technology; M. L. Yates, tenable at Manchester College of Technology.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

30,154. "Automatic cut-out devices for electric circuits." L. Drault et C. Raulot-Lapointe. November 3rd. (France, December 22nd, 1921.)
30,155. "Self-regulating dynamos." H. Crochat Etablissements. November 3rd. (Belgium, November 26th, 1921.)
30,156. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 3rd.
30,172. "Thermionic valves for wireless telegraphy, &c." C. H. Roddis. November 4th.
30,210. "Telephone receivers." R. L. Murray and Telephone Manufacturing Co., Ltd. November 4th.
30,212. "Apparatus for starting electric motors." A. Schulze. November 4th.
30,247. "Electric gravity contact signal lamp." R. A. Galloway. November 6th.
30,260. "Resistance for wireless and electric sets." A. Davison, H. St. J. Ward, and C. F. Westerby. November 6th.
30,262. "Electric bonding junction-boxes for metallic-sheathed wires, &c." S. J. Bryce and Callender's Cable and Construction Co., Ltd. November 6th.
30,292. "Means for simultaneously transmitting and receiving a number of wireless messages." F. W. V. Fitzgerald. November 6th.
30,297. "Ignition apparatus for internal-combustion engines." A. C. Lock. November 6th.
30,302. "Polarised electromagnets and their application to railway block instruments, &c." J. W. Punter and Tyer & Co., Ltd. November 6th.
30,309. "Electrically-illuminated signs." S. Sherman. November 6th.
30,335. "Gauges for indicating condition of electric accumulators, &c." Chloride Electrical Storage Co., Ltd., and H. Dean. November 6th.
30,352. "Electric light fittings." T. Phillips. November 7th.
30,368. "Sparking plugs." R. Bosch Akt. Ges. November 7th. (Germany, August 28th.)
30,372. "Electric switches." W. Preston. November 7th.
30,399. "Stereoscopic X-ray apparatus." L. R. McDonald. November 7th.
30,411. "Cleaning and lubricating device for electrical machinery, &c." P. A. Lothbury and C. B. Pinkerton. November 7th.
30,425. "Illuminated advertising signs, &c." R. H. Parkinson. November 7th.
30,429. "Combined starting, lighting, ignition, and cooling device for internal-combustion engines." H. F. Rae. November 7th.
30,437. "Holders for electric lamp bulbs." L. Berkovi. November 7th.
30,447. "Electrical instrument for detection of smoke in the atmosphere." A. M. Dickinson and H. Dickinson. November 7th.
30,452. "Devices for transmitting signals on railways, &c." H. E. Guerrier. November 7th.
30,456. "Illuminating devices." British Thomson-Houston Co., Ltd., W. Milliner, and H. C. Wheat. November 7th.
30,466. "Telephone systems." Siemens & Halske Akt. Ges. November 7th. (Germany, January 2nd.)
30,467. "Wireless telegraphy." J. B. Bower. November 7th.
30,468. "Means for generating electric oscillations." Ges. für Drahtlose Telegraphie. November 7th. (Germany, February 14th.)
30,469. "Valve amplifiers for electric oscillations." Ges. für Drahtlose Telegraphie. November 7th. (Germany, November 19th, 1921.)
30,470. "Employment of thermionic valves in radio communication, &c." Sterling Telephone & Electric Co., Ltd. November 7th.
30,471. "Means for indicating interruptions in ignition circuits." H. Ness and L. F. Nortier. November 7th.
30,493. "Telephone apparatus." L. Schmidt. November 7th.
30,501. "Electro-magnetic device for use with petrol, &c., engines." R. C. Grasby. November 8th.
30,514. "Earthing running rails, &c." J. McCreath. November 8th.
30,516. "Connections between co-axial armatures of rotating machines." Ateliers de Constructions Electriques de Charleroi. November 8th. (Belgium, November 8th, 1921.)
30,521. "Electric motor starters." Brook, Hirst & Co., Ltd., and J. A. Hirst. November 8th.
30,522. "Automatic, &c., telephone systems." G. H. Bryant and Relay Automatic Telephone Co., Ltd. November 8th.
30,558. "Wireless apparatus." G. C. Aimer. November 8th.
30,559. "Wireless inductance coils." G. C. Aimer. November 8th.
30,571. "Means for operating points and/or cable switches of tramways, &c." G. Bromilow. November 8th.
30,575. "Electric motor-control apparatus." British Thomson-Houston Co., Ltd., E. P. Tuppen, and G. O. Watson. November 8th.
30,576. "Insulating composition." British Thomson-Houston Co., Ltd. (General Electric Co.). November 8th.
30,582. "Rotary electrodes for metal welding." S. H. Gordon and Rose Street Foundry and Engineering Co., Ltd. November 8th.
30,583. "Adapting electric bell installations for use as fire alarms." G. L. Jones. November 8th.
30,597. "Insulating and waterproofing materials." T. Pittman. November 8th.
30,598. "Soft-iron tele-compass." Soc. des Etablissements Gaumont. November 8th. (France, December 28th, 1921.)
30,606. "Electric switches." J. H. Hewitt and Wilkins & Wright, Ltd. November 9th.
30,636. "Automatic, &c., telephone systems." W. Aitken. November 9th.
30,640. "Safety device for preventing opening of enclosing parts of electric switchgear." P. S. Brook and J. A. Hirst. November 9th.
30,647. "Annunciator." W. Farquharson. November 9th.
30,648. "Pliers for electric welding." E. T. Baker and T. Piggot & Co., Ltd. November 9th.
30,667. "Variable electric condensers." G. F. Barrington. November 9th.
30,669. "Electric burglar alarms." A. V. Cannon and M. J. Railing. November 9th.
30,680. "Soft-iron tele-compass." Soc. des Etablissements Gaumont. November 9th. (France, March 24th.)
30,713. "Single-conductor or multi-concentric cables." A. M. Taylor. November 10th.
30,723. "Electric switches for starting electro-motors, &c." H. W. Cox. November 10th.
30,728. "Inductance coil." H. P. Ward. November 10th.
30,732. "Electric fuses." E. D. Rodway and Switchgear & Cowans, Ltd. November 10th.
30,733. "Contactor starting switches." E. N. Bray and E. N. Bray, Ltd. November 10th.
30,742. "Wireless receiving systems, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. November 10th.
30,743. "Electric circuits for thermionic valves." N. Lea and Radio Communication Co., Ltd. November 10th.
30,744. "Wireless receiving systems, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. November 10th.
30,745. "Grid condensers, leaks, &c." Radio Press, Ltd., and P. D. Tyers. November 10th.
30,753. "Receiving apparatus for radio signals." J. B. Nowlan. November 10th.
30,759. "Means for supporting filaments, &c., in thermionic tubes." H. G. Hughes, L. G. Preston, and A. L. Kirkham. November 10th.
30,781. "Controlling means for drop windows." British Electrical Federation, Ltd. November 10th.
30,783. "Electric pocket lamps." M. Rocher. November 10th.
30,790. "Lightning arresters." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). November 10th.
30,792. "Device for wireless telegraphy, &c." T. J. Simms. November 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

12,138. "High-frequency telephone systems." Ges. für Drahtlose Telegraphie. May 20th, 1920. (163,691.)
13,084. "Dynamo-electric machinery applicable for electric welding." Brush Electrical Engineering Co., Ltd., B. A. M. Boyce, and P. Huggins. May 7th, 1921. (Cognate application No. 16,595/21.) (187,644.)
13,977. "Thermionic devices." H. J. Round. May 18th, 1921. (187,646.)
14,325. "Control of dynamo-electric machines." A. H. Midgley. May 23rd, 1921. (187,649.)
14,404. "Electro-magnetic wave-signalling apparatus." J. O. Mauborgne and G. Hill. May 24th, 1920. (163,709.)
16,875. "Electric oscillation valves." Dr. E. F. Huth Ges. June 18th, 1920. (165,096.)
17,313. "Emergency lamps for use on motor vehicles, or for other purposes." H. S. Johnson. June 24th, 1921. (187,662.)
17,495. "Fly-wheel dynamo-electric machines for internal-combustion engines." R. L. Aspden. June 27th, 1921. (187,665.)
17,798. "Construction of electrical heating elements." W. Weekes. March 29th, 1922. (187,667.)
19,616. "Coin mechanism for prepayment telephone call apparatus." G. H. Huntsworth and T. G. Anderson. July 21st, 1921. (187,689.)
19,712. "Electric alarms." A. W. Amos, W. E. Lloyd, and A. L. Lloyd. July 22nd, 1921. (187,696.)
19,840. "Electric signal apparatus." H. Wade (E. P. Severance). July 23rd, 1921. (187,707.)
19,853. "Adjusting device for electric meters, measuring apparatus, and other similar apparatus." New Antwerp Telephone and Electrical Works. July 24th, 1920. (166,898.)
19,917. "Duplex and the like telegraphic systems." H. W. Sullivan. July 25th, 1921. (187,713.)
19,930. "Electrical circuit breaker for vulcanising apparatus." A. Ludi. July 25th, 1921. (Convention date not granted.) (166,904.)
20,069. "Dry batteries." Ever Ready Co. (Great Britain), Ltd. ("Hoka" Elektrotechnischefabrik Ges.). July 26th, 1921. (187,723.)
20,672. "Telephone systems." Western Electric Co., Ltd., and G. Deakin. August 3rd, 1921. (187,736.)
20,687. "Electric condenser and clamp therefor." W. Dubilier. February 7th, 1921. (175,236.)
20,793. "Mercury motor meters." A. E. White (Sangamo Electric Co.) August 4th, 1921. (187,737.)
20,841. "Directional wireless apparatus." J. Robinson. August 5th, 1921. (187,738.)
20,925. "Electric heating." H. Harrison. August 6th, 1921. (187,739.)
21,252. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 10th, 1921. (187,747.)
21,725. "Electric radiators." C. W. Marriott. August 16th, 1921. (187,755.)
22,523. "Interlocking mechanism, particularly mechanism for electric and like controllers." British Thomson-Houston Co., Ltd., and R. F. Halliwell. August 24th, 1921. (187,767.)
22,875. "Control means for electric motors." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 29th, 1921. (187,775.)
23,021. "Electric motor starters." British Thomson-Houston Co., Ltd. (General Electric Co.). August 30th, 1921. (187,784.)
23,319. "Electrically-lighted sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (187,785.)
23,731. "Electrical plug connectors for use with flexible conductors." British Thomson-Houston Co., Ltd. (General Electric Co.). September 6th, 1921. (187,789.)
25,060. "Electrical connection and lighting boxes for mines and industrial purposes." E. B. Williams. September 21st, 1921. (187,801.)
25,797. "Operating mechanisms for electrical switches." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1921. (187,811.)
26,330. "Magnetic blow-out devices for use with electric-circuit controlling apparatus." G. Ellison and J. Anderson. October 5th, 1921. (Cognate application 5,093/22.) (187,821.)
26,567. "Electric current interrupting devices." Chamberlain & Hookham, Ltd., and S. James. October 7th, 1921. (187,823.)
27,561. "Telephone systems." Siemens & Halske Akt. Ges. October 16th, 1920. (170,308.)
27,763. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 19th, 1921. (187,837.)
32,365. "Calling apparatus for high-frequency telegraphy." Ges. für Drahtlose Telegraphie. December 4th, 1920. (172,321.)
32,725. "Fastening transformers in their oil tanks." S. Z. de Ferranti and Ferranti, Ltd. December 6th, 1921. (187,879.)
33,077. "Ignition devices for internal-combustion engines." E. H. Tartrais. December 22nd, 1920. (173,221.)
34,286. "Galvanic batteries." Fuller's United Electric Works, Ltd., and A. P. Welch. December 20th, 1921. (187,892.)
34,405. "Electric insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). December 21st, 1921. (187,893.)
34,645. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 21st, 1921. (174,332.)

1922.

486. "Electric starters for internal-combustion engines." Scintilla (firm of). January 15th, 1921. (Addition to 161,588.) (174,063.)
782. "Spark-gap devices for internal-combustion engines having electric ignition." G. F. C. Joly. May 28th, 1921. (180,977.)
1,481. "Electric organ actions." T. H. S. Jones and H. S. Jones. January 17th, 1922. (187,899.)
1,774. "Oil switches." Sachsenwerk Licht und Kraft Akt. Ges. April 21st, 1921. (Addition to 172,982.) (178,803.)
5,096. "Thermionic tubes and the like." J. H. Swinton Whittaker. July 20th, 1921. (Divided application on 177,816.) (187,907.)
5,541. "Insulating tubes or guides for high-tension electric conductors." Meirowsky & Co. Akt. Ges. March 19th, 1921. (177,499.)
6,008. "Double pole for the supporting of telegraph, telephone, and electric power wires." J. E. Rutter. March 1st, 1922. (187,909.)
10,348. "Prepayment meters for gas, water, electricity, and other similar commodities." Landis & Gyr Akt. Ges. April 12th, 1921. (178,439.)
14,009. "Cooling of electric transformers and similar apparatus." W. H. Simms (Bureau d'Organisation Economique). May 18th, 1922. (Convention date not granted.) (187,921.)
16,733. "Trucks for tramway or railway vehicles." S. Thomas and Peckham Truck and Engineering Co., Ltd. August 15th, 1921. (Divided application on 185,009.) (187,927.)
18,873. "Automatic electric switching device." E. Mugerle. July 21st, 1921. (183,444.)
21,767. "Electric-current limiting device." Aktiebolaget Birka Regulator. September 30th, 1920. (Divided application on 169,696.) (184,481.)
22,007. "Control systems for dynamo-electric machines." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. January 27th, 1922. (Divided application on 183,592.) (187,928.)
25,566. "Electric switches." W. A. Coates, G. E. Gittins, D. R. Davies, and Metropolitan-Vickers Electrical Co., Ltd. July 13th, 1921. (Divided application on 186,733.) (187,565.)